PROGRESSIVE MEDICINE

A QUARTERLY DIGEST

OF

ADVANCES, DISCOVERIES AND IMPROVEMENTS IN THE MEDICAL AND SURGICAL SCIENCES
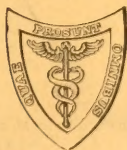
EDITED BY

HOBART AMORY HARE, M.D.

Professor of Therapeutics and Materia Medica in the Jefferson Medical College, Philadelphia

ASSISTED BY

H. R. M. LANDIS, M.D.

Assistant Physician to the Out-Patient Medical Department of the Jefferson Medical College Hospital

JUNE 1, 1906

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HOBART AMORY HARE, M.D.,

PROFESSOR OF THERAPEUTICS AND MATERIA MEDICA IN THE JEFFERSON MEDICAL COLLEGE OF PHILA-
DELPHIA ; PHYSICIAN TO THE JEFFERSON MEDICAL COLLEGE HOSPITAL ; ONE TIME CLINICAL
PROFESSOR OF DISEASES OF CHILDREN IN THE UNIVERSITY OF PENNSYLVANIA ;
MEMBER OF THE ASSOCIATION OF AMERICAN PHYSICIANS, ETC.

ASSISTED BY

H. R. M. LANDIS, M.D.,

VISITING PHYSICIAN TO THE TUBERCULOSIS DEPARTMENT OF THE PHILADELPHIA HOSPITAL,
TO THE WHITE HAVEN SANATORIUM AND TO THE PHIPPS INSTITUTE ; DEMONSTRATOR
OF CLINICAL MEDICINE IN THE JEFFERSON MEDICAL COLLEGE.

VOLUME II. JUNE, 1906.

HERNIA—SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA—GYNECOLOGY
—DISEASES OF THE BLOOD. DIATHETIC AND METABOLIC DISEASES.
DISEASES OF THE SPLEEN, THYROID GLAND, AND
LYMPHATIC SYSTEM—OPHTHALMOLOGY.
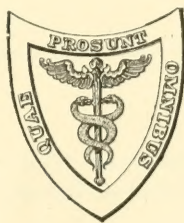
LIST OF CONTRIBUTORS.

WILLIAM T. BELFIELD, M.D.,

Associate Professor of Surgery in the Rush Medical College; Professor of Genito-urinary and Venereal Diseases in the Chicago Polyclinic, Chicago.

JOSEPH C. BLOODGOOD, M.D.,

Associate in Surgery, Johns Hopkins University, Baltimore, Md.

JOHN ROSE BRADFORD, M.D., F.R.C.P., F.R.S.,

Professor of Medicine and Physician to the University College Hospital, London.

JOHN G. CLARK, M.D.,

Professor of Gynecology in the University of Pennsylvania, Philadelphia.

WILLIAM B. COLEY, M.D.,

Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital for Ruptured and Crippled; Clinical Lecturer in Surgery and Instructor in Surgery at the College of Physicians and Surgeons, Columbia University, New York.

FLOYD M. CRANDALL, M.D.,

Adjunct Professor of Pediatrics, New York Polyclinic Hospital; Visiting Physician to the Minturn Hospital for Scarlet Fever and Diphtheria; Consulting Physician to the Infants' and Children's Hospitals, New York.

WILLIAM EWART, M.D., F.R.C.P.,

Physician to and Joint Lecturer on Medicine at St. George's Hospital, and Physician to the Belgrave Hospital for Children, London.

EDWARD MILTON FOOTE, M.D.,

Instructor in Surgery, Columbia University; Visiting Surgeon, New York City Hospital.

CHARLES H. FRAZIER, M.D.,

Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Howard, and Philadelphia Hospitals.

WILLIAM S. GOTTHEIL, M.D.,

Professor of Dermatology and Syphilology, New York School of Clinical Medicine; Consulting Dermatologist to the Sheltering Guardian Orphan Asylum; Dermatologist to the Lebanon and Beth Israel Hospital, and to the German West Side Dispensary, New York.

D. BRADEN KYLE, M.D.,
> Professor of Laryngology in the Jefferson Medical College, Philadelphia.

EDWARD JACKSON, M.D.,
> Professor of Ophthalmology in the University of Colorado; Ophthalmologist to the City and County Hospital of Denver.

H. R. M. LANDIS, M.D.,
> Visiting Physician to the Tuberculosis Department of the Philadelphia Hospital, to the White Haven Sanatorium and to the Phipps Institute ; Demonstrator of Clinical Medicine in the Jefferson Medical College.

RICHARD C. NORRIS, M.D.,
> Assistant Professor of Obstetrics in the Medical Department of the University of Pennsylvania, Philadelphia; Physician-in-Charge of Preston Retreat.

ROBERT B. PREBLE, A.B., M.D.,
> Professor of Medicine in Northwestern University Medical School; Attending Physician to Cook County, St. Luke's, Wesley, German, and Polyclinic Hospitals, etc., Chicago.

B. ALEXANDER, RANDALL, M.D.,
> Professor of Otology in the University of Pennsylvania, Philadelphia.

WILLIAM G. SPILLER, M.D.,
> Professor of Neuropathology and Associate Professor of Neurology in the University of Pennsylvania ; Clinical Professor of Nervous Diseases in the Woman's Medical College of Pennsylvania and in the Philadelphia Polyclinic.

J. DUTTON STEELE, M.D.,
> Associate in Medicine, University of Pennsylvania, Philadelphia.

ALFRED STENGEL, M.D.,
> Professor of Clinical Medicine in the University of Pennsylvania, Philadelphia.

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PROGRESSIVE MEDICINE.

JUNE, 1906.

HERNIA.

By WILLIAM B. COLEY, M.D.

HERNIA.

Inguinal Hernia. The question as to whether there are any good reasons for *transplanting the cord in the radical cure of inguinal hernia* is taken up by Connell.[1] Connell states that in practically all cases of inguinal hernia there is a decrease in the obliquity of the canal, and that the restoration to its normal obliquity is the main principle on which are based the operations of Marcy, Bassini and Halsted, whose combined work, he believes, has been of the utmost importance in bringing the radical cure to its present high standard. Despite the improvements in the results from these methods, he believes that there is still some dissatisfaction, as is shown by the number of new improved methods that have been submitted, notably the method of Ferguson, of Chicago, who does not believe in the transplantation of the cord. Connell states that while many operators have found the lower border of the internal oblique muscle above the internal ring, the majority have considered this as the result of the protrusion of the sac. Ferguson looks upon this malposition of the muscle, or a congenitally deficient origin of the internal oblique from Poupart's ligament, as a cause and not an effect of the rupture. Connell believes this view of Ferguson's substantiated by dissections and experiments upon the cadaver.

Personally, I believe that the evidence derived from a very large number of operations for hernia, which are really dissections upon the living body, is far more important than that derived from dissections and experiments upon the cadaver. The large and constantly increasing operative experience strongly confirms the opinion that the underlying cause of inguinal hernia, in the great majority of cases, is a

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[1] American Journal of the Medical Sciences, March, 1905.

2

pre-existing sac of congenital origin. While a deficiency in the development of the internal oblique muscle may favor the production of an inguinal hernia in the presence of an exciting cause, it plays a very small role, compared with a congenital or pre-existing sac.

Connell states that Woelfler, in 1892, was probably the first to suggest that a radical cure might be effected without the transplantation of the cord. E. W. Andrews, in 1895, suggested such an operation, but did not recommend it; while Ferguson, in 1899, presented his method, which he had performed sixty-four times during the previous eighteen months. In his paper, Ferguson said: " Leave the cord alone, for it is the sacred highway along which travel vital elements indispensable to the perpetuity of our race."

That the transplantation of the cord, as done in Bassini's method for the radical cure of inguinal hernia, might interfere with " the perpetuity of the race," is an apprehension based upon imagination rather than experience. There are absolutely no data to prove that the functions of the testes are in any way more interfered with when the cord is transplanted than when it is not. Of upward of 1500 male children operated upon at the Hospital for Ruptured and Crippled, by Bassini's method, during the last sixteen years, we have seen many grow up to vigorous manhood, and not a single case of atrophy of the testis has been observed, so that I believe that some stronger objection than this to Bassini's method would have to be offered to prove the wisdom of abandoning it. A few days ago, I examined a man aged twenty-eight years, upon whom I did a Bassini operation fourteen years ago, then a boy of fourteen. There is absolutely no difference in the size of the testes, and he is married and has two fine boys.

Whether or not equally good results may not be obtained by the method advocated by Ferguson or other authors is another question, and one open to discussion. Before Woelfler's paper was published, and three years before Andrews suggested such an operation, we operated upon a number of cases at the Hospital for Ruptured and Crippled, without transplanting the cord. In the *Annals of Surgery*, April, 1895, I seriously discussed the question whether or not the transplantation step was actually necessary, and I there stated: " Whether the transplantation of the cord is to be regarded as essential to the highest degree of success in hernia operations, it is hardly possible to state positively. It may be that the high ligation of the sac, and the perfect closure of the canal made possible by slitting up the aponeurosis, have quite as much to do with the good results as transplanting the cord. None of my own cases operated upon by this method, *i. e.*, without transplanting the cord, though using the same sutures (kangaroo tendon and chromicized cat gut) has relapsed, and some have gone more

than three years. One was a very large double hernia (the size of an orange) operated upon in April, 1892. The boy is perfectly sound at present, nearly three years later; and another very large strangulated sigmoid hernia is well, three and a quarter years after operation. It is true, the number of cases operated upon by this method is too small to compare them with the cases operated upon by Bassini's method, or to draw absolute conclusions."

The objections to the transplantation step offered by Connell are: Interference with the circulation and the function of the testicle, and it is stated that orchitis and epididymitis, even hydrocele and varicocele have followed Bassini's operation in a certain number of cases, in proof of which is quoted the statistics of Bloodgood, the author reasoning that though rare in the hands of experts, such results would probably result more frequently in the hands of the ordinary operator. It should be noted, however, that the statistics of Bloodgood are based upon Halsted's operation and not Bassini's, a very important point for the reason that in the Halsted method as done at Johns Hopkins Hospital, it was a routine measure to remove a large portion of the veins which undoubtedly was a predisposing cause of orchitis and epididymitis.

I can only say that at the Hospital for Ruptured and Crippled, where the veins have not been removed and transplantation of the cord has been done according to the Bassini method, epididymitis, hydrocele or varicocele have been the very rarest occurrences, and they have been seen no more frequently than in the cases in which the cord was not transplanted. The second objection offered is the strengthening of the posterior wall at the expense of the anterior. Connell states that the surgeons who employ the Bassini method, aim to obtain a strong posterior wall or floor. He believes it just as rational to devote the same time and less trouble to making a strong anterior wall. This objection seems of little or no value, inasmuch as the chief object is to cure the hernia, the impartial surgeon caring little whether it be by a strong anterior or strong posterior wall.

The third objection is the complexity of the operation and it is stated that " when compared to the new methods, those that transplant the cord will be found to be more complicated and time-consuming," and that they " necessitate more handling, and in consequence, a greater possibility of infection."

This objection I believe to be more theoretical than practical. I have operated upon a considerable number of cases without transplanting the cord and find practically no difference between the amount of time consumed in the two operations. Bassini's method with the transplantation of the cord can be easily done in ten minutes by one familiar with the operation, and I have done it in seven. As regards the greater

possibility of infection, there is no proof of this. In my own experience,
I have found infection to occur in less than 1 per cent. within the last
seven years, *i. e.*, since the time that rubber gloves were introduced.

The fourth objection to the transplantation of the cord is stated as
" Recurrence." Yet the author admits that present data furnishes no
proof that there is a larger percentage of recurrences following Bassini's
operation than the method without the transplantation of the cord. A
comparision of results of the two methods at the Hospital for Ruptured
and Crippled shows a slightly increased percentage where the cord has
not been transplanted.

The *curability of hernia at all ages by operation* is discussed by
Deanesly,[1] who attempts to prove that the popular view of the etiology
of a hernia, attributing it to a strain, is erroneous. While strain may
be the immediate or exciting cause of the protrusion, he believes that
the real cause lies in a congenital, or pre-existing sac. If the existence
of such a sac be the chief cause of a hernia, he reasons, the removal of
said sac should, in most cases, effect a cure. He states that he has
operated on all herniæ, large or small, and without any regard to age
or the condition of the parietes, and has not found recurrence more
frequent in large than in small herniæ, nor in old persons than in young.

While accepting in the main his contention that a pre-existing sac,
in the majority of cases of inguinal hernia, is the chief cause, I do not
agree with his statement that recurrence is no more frequent in the
large herniæ than in the small, nor in the old than in the young. This
certainly is by no means true of direct inguinal hernia, in most of which
cases no distinct sac is found, but only a bulging of considerable
diameter, at the external ring. Here the defect in the abdominal wall
is a far more important consideration than the sac. Then, again, the
results are distinctly better in children and young adults than in middle-
aged and elderly people.

Deanesly refers to 142 personal operations that were followed up for
two years or more after operation, and proves that the operation which
effectually removes the sac is followed by radical cure in 95 per cent.
of the cases. He believes that the method of Kocher is the simplest,
most rapid and easiest to perform, and this method was used in the
majority of his cases.

As regards the age of his patients, this varied between three months
and seventy years; fourteen individuals being under two years. There
was one death, exclusive of strangulated cases, occurring in an infant
eighteen months old.

Eleven of the 142 operations were for femoral hernia, the remainder

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[1] British Medical Journal, June 17, 1905, p. 1328.

for inguinal; three were for direct hernia. Six relapses were noted; all the relapses occurred within twelve months after operation.

Deanesly states that those who practice Bassini's operation admit that suppuration of the wound is extremely likely to be followed by relapse of the hernia. The admission that suppuration in the wound is likely to be followed by relapse, by no means applies to Bassini's method alone, but to all methods with equal force. Personally, I do not believe that there is any more probability of suppuration occurring after Bassini's method than after Kocher's. I have operated upon 200 consecutive cases with one suppuration, and in this case there was no relapse. Deanesly's percentage of 4.2 of relapses does not represent any better results, if as good, as may be obtained from Bassini's method. At the Hospital for Ruptured and Crippled, in upward of 1700 cases, we have had less than 1 per cent. of relapses.

Gwilym G. Davis[1] describes a new method for the *radical cure of direct inguinal hernia.*

Davis starts out with the very true statement that direct hernia is not so well understood as either oblique, inguinal, or femoral hernia, and not infrequently its operative treatment is quite difficult, and not always satisfactory. He states that there are two forms of direct hernia, one which pushes its way through the conjoined tendon and comes out of the external ring; the other bulges around the outer end of the conjoined tendon and gradually decreases in size as it extends out toward the deep epigastric artery; the latter form being pear-shaped rather than spherical. The difficulty in effecting a radical cure for direct hernia, he points out, lies in the fact that the muscular and tendinous tissues are much less abundant than in indirect hernia. The method usually employed to overcome the weakness caused by this deficiency is that of Wölfler and Bloodgood. It consists in opening the sheath of the rectus, pulling its fibres outward and sewing them to Poupart's ligament. The incision for exposing the rectus is well shown in Fig. 1. This incision is practically made through the lower edge of the conjoined tendon, since this latter fades away into the transversalis fascia in the direction of the deep epigastric artery. The transversalis fascia is then pushed back from the posterior surface of the rectus and the conjoined tendon lifted from its anterior surface. The rectus having been transplanted as far out as possible, the arching fibres of the internal oblique and conjoined tendon are brought down and sutured to Poupart's ligament beneath the cord, as in Bassini's operation. The external oblique is then sutured over the cord—overlapping or otherwise as may be desired.

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[1] Annals of Surgery, January, 1906.

In the other form of direct hernia which Davis distinguishes, he states that the rounded, hemispherical tumor presents itself just above the external ring with the cord below. One of the conditions found, especially if the hernia is of long duration, is that the hernial coverings from the intestine within to the superficial fascia without will be a single, thick, strong membrane which it is impossible to separate into

FIG. 1
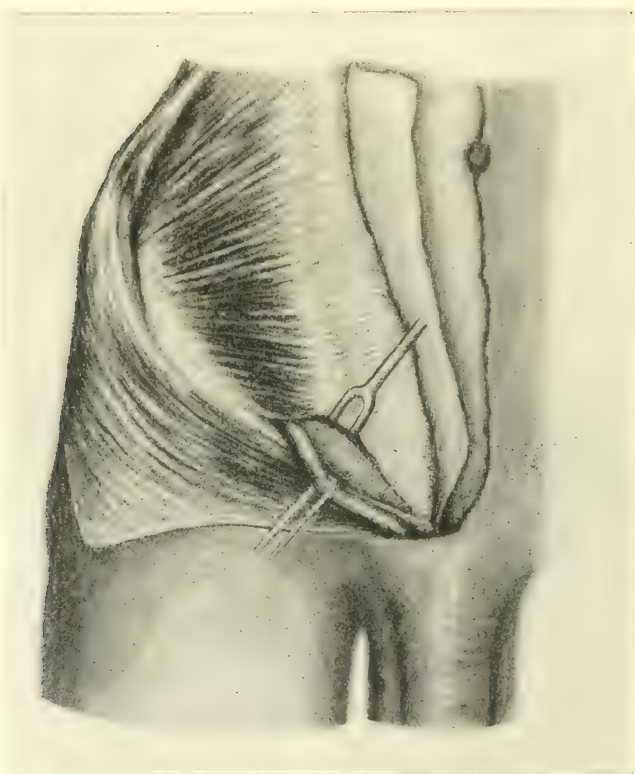
Showing incision from muscular fibres of the internal oblique to the spine of the pubis, to expose the edge of the rectus muscle.

layers. When such a condition was found, Davis states that in several cases he has divided the sac transversely and overlapped its two parts, suturing the apex of the lower flap to the base of the upper and then bringing down the upper flap and suturing it in place, as is done in Mayo's operation for umbilical hernia. In the latter method the peritoneum is dissected off which, however, Davis does not consider wise, as it is firmly blended with the other tissues and gives considerable

strength to the flaps, while alone it is too weak to be of much service
(Figs. 2 and 3).

A strong plea for *local anæsthesia in the radical cure of inguinal hernia*
has recently been made by John A. Bodine, of New York, who reports
300 operations performed under *cocaine anæsthesia*.[1] These operations

Fig. 2
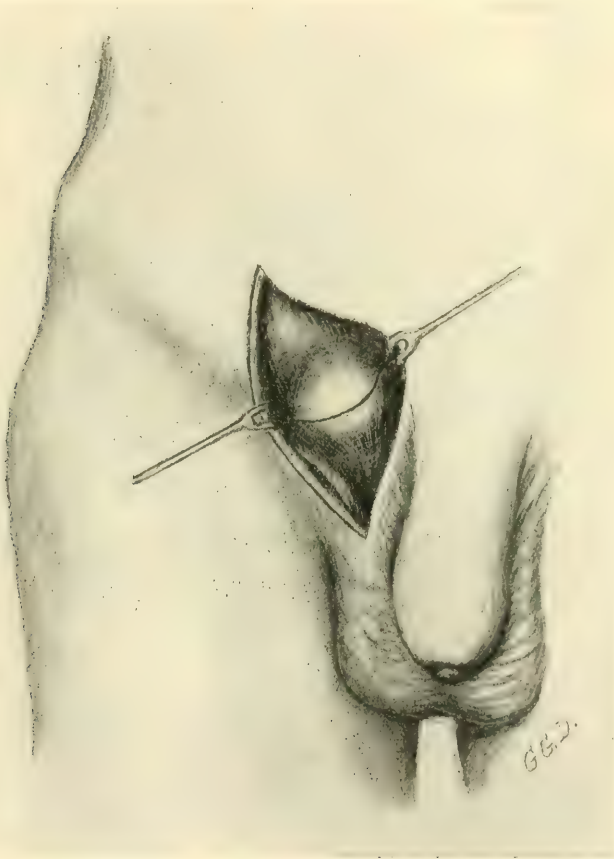
were done in 284 patients, 16 being double; 275 male and 9 female.
The youngest patient was fifteen, the oldest eighty years of age. Ten were
strangulated herniæ. The omentum was amputated, in more or less
quantity, twelve times. The appendix was found with the contents of the
sac three times and excised in every case. Undescended testicle was seen
once; the organ was removed. The duration of the patients' stay at the

[1] New York Medical Record, Oct. 21, 1905.

hospital was two weeks, they resuming work one week after leaving the hospital. The amount of cocaine used in no case exceeded 0.5 grain. There were no deaths and it is stated that no wounds suppurated. Bodine states: "The anatomy of the inguinal region is so constructed in accessibility, regional restriction, paucity of bloodvessels, and above all in sensory nerve supply, as to make the operation in question the most favorable in general surgery for local anæsthesia." "In strangu-

Fig. 3
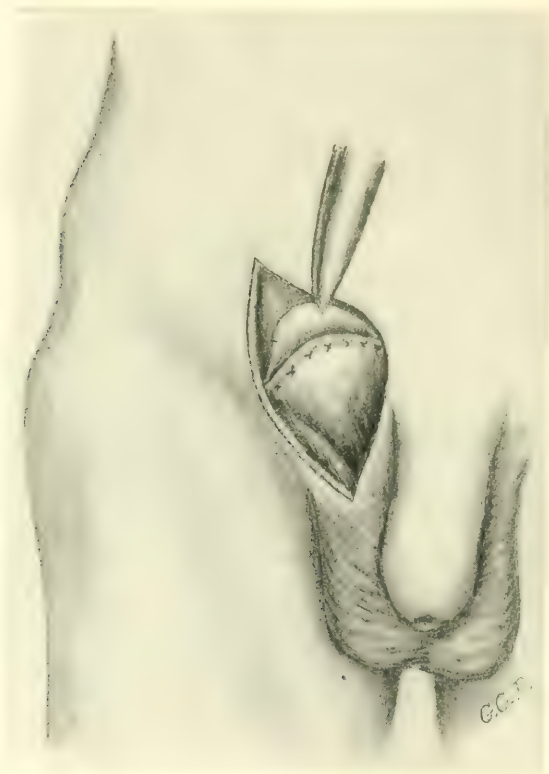
lated hernia with profound shock and toxemia," he says, "this method finds an imperative application." He calls attention to the fact that in strangulated hernia the vitality of a coil of gut may frequently be determined if hot saline towels are applied long enough, and while with local anæsthesia this may be done for an hour or more, general anæsthesia for such length of time, added to the existing shock, might annihilate all chance of recovery, placing before the surgeon the alternative of resecting or returning the doubtful loop.

While personally I have never been convinced of the wisdom of substituting local anæsthesia for general anæsthesia, in the operation for the radical cure of inguinal hernia, Bodine's results certainly show the possibility of operating satisfactorily upon such cases by this means. If it can be proven that the slight risks of general anæsthesia are greater than those connected with the much longer duration of operation, if performed under local anæsthesia, and if the results prove equally good, the plea for local anæsthesia will prove a strong one. Bodine's statistics certainly show that primary wound healing can be obtained equally well with local anæsthesia, and thus far the results as regards permament cure seem equally good.

Fig. 4
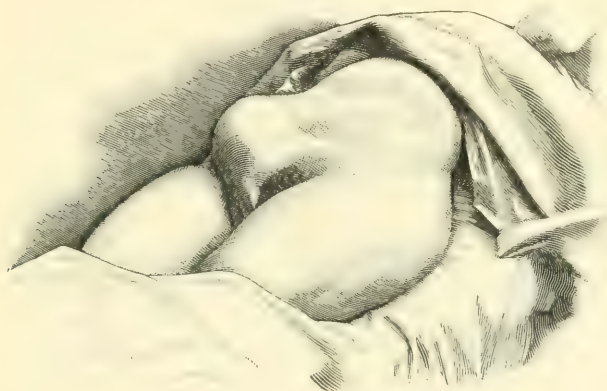
Interstitial Hernia. This subject is carefully reviewed by Cumston,[1] of Boston. After a brief historical reference, he divides these cases into three groups, the classification usually adopted:

1. Properitoneal inguinal, situated between the parietal peritoneum and the fascia transversalis.

2. Interstitial inguinal, situated in the layers of the abdominal wall.

3. Superficial inguinal, found between the superficial fascia and the external oblique muscle.

He calls attention to the fact that this variety of hernia occurs much more frequently in the male than in the female; of 115 cases collected by Göbell only four were in women. Out of 11 cases of interstitial hernia collected up to the year 1900, he states that not one was observed in the female. Cumston believes that Auvray was the first to record a case of interstitial hernia in the female in 1900. Cumston states that the second case, operated upon by Helferich, was reported by Müller in

[1] Annals of Surgery, March, 1905.

1901, and a third case by Fredet in the same year. Two further cases were related by Brunco in his thesis.

Cumston has overlooked the case of properitoneal hernia in the female published by myself nine years prior to the case of Auvray.[1] In this report I described a case of properitoneal epiplocele with much serous effusion in an hour-glass sac, resembling a cystic tumor of the abdominal wall. Operation disclosed a sac containing several ounces of clear fluid extending down into the right labium. Above this sac and connected with it by means of a small lumen was another sac, containing a mass of thickened omentum, the size of a fist. "The position of the hernial sac was apparently between the transversalis fascia and the overlying muscles."

In regard to the etiology of properitoneal hernia in the female, the explanation offered by Dr. Bull and myself in our article in Dennis' *System of Surgery*, that hydrocele in the canal of Nuck in the female may be an etiological factor, is referred to by Cumston. He says that while it may be possible, as far as he is aware, no such case has been reported. The case which I have just referred to is one directly in point. Here there was present a large hydrocele of the canal of Nuck which offered exactly the same resistance to the downward progress of the hernia as does the undescended testis in the male. To our minds it was the direct causative factor in the production of the pro-peritoneal hernia.

Cumston himself reports a case of interstitial hernia in a girl nine years of age, operated upon in August, 1904.

The Radical Cure of Femoral Hernia, with a report of results of 110 operations by a single method, is discussed by De Garmo.[2] This, I believe, is the largest number of operations for femoral hernia yet reported by a single operator, with results that have never been equalled. The accompanying cuts show the main features of the operation, which consists in an incision two to three inches long, parallel with and to the inner side of the femoral vessels (Fig. 5). Careful removal of the subperitoneal fat that usually surrounds the sac; high ligation of sac; closing of femoral canal by four interrupted sutures of kangaroo tendon placed as shown by the diagrams. These sutures being Poupart's ligament or the roof of the canal into approximation with the pectineal muscle and fascia. He uses a blunt, curved needle, similar to an aneurysm needle in closing the femoral opening. The essential features of this operation are almost identical with those of Bassini's method,

[1] A Clinical Report of Operative Surgery in the Service of Dr. Wm. T. Bull at the New York Hospital, New York Medical Journal, April 18 to August 29, 1891.

[2] Annals of Surgery, August, 1905.

although De Garmo's method is somewhat simpler, inasmuch as he uses only two to four sutures, where Bassini uses seven.

De Garmo's 110 operations were performed in 99 patients, 83 female and 16 male. The youngest patient was eight years and the oldest eighty-one years old. Four were under ten years of age; 6 between ten and twenty; 18 between twenty and thirty; 34 between thirty and forty; 15 between forty and fifty; 11 between fifty and sixty; 5 between sixty and seventy; 5 between seventy and eighty; 1 over eighty years.

FIG. 5
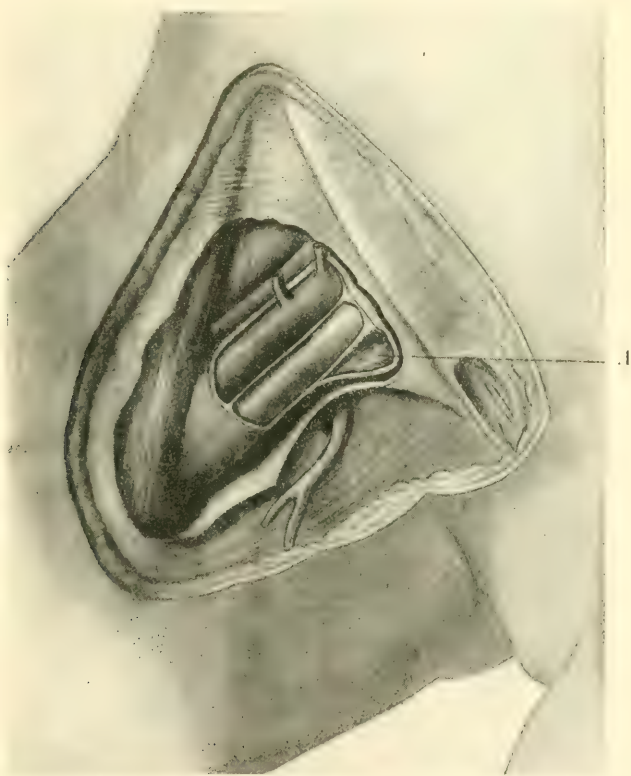
A, showing small pocket by side of femoral vessels where hernia usually protrudes, breaking down Gimbernat's ligament and forming an elongated, triangular opening. The top of this triangle is Poupart's ligament, the floor the tissues covering the ramus of the pubes, its base the femoral vessels, and its point the spine of the pubes. (Gray.)

The only death that occurred was that of an old woman, seventy-eight years of age, in whom the operation was done for strangulation. A recurrence was observed in only one case, and was apparently brought on by violent vomiting three weeks after operation. A second operation

was performed eight months later, and the patient has now remained
well over three years. De Garmo states that in one other case in
which a recurrence was supposed to have taken place, the second oper-
ation revealed the fact that the protrusion was subperitoneal fat which
had slipped under Poupart's ligament, but no hernial sac had formed.
In another case believed to be identical with the one just related, a
woman thirty-five years of age, a small swelling appeared in the femoral

Fig. 6
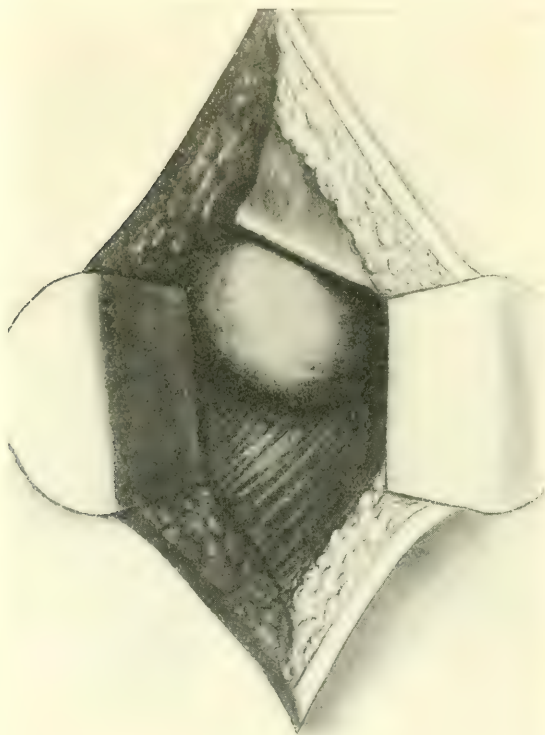
Showing protrusion under Poupart's ligament. The femoral vessels are to the outer
side of the sac. The sac should have been shown with smaller neck.

region nine months after operation. A light truss was applied and
worn for one year. She has now been five years without support, and
no protrusion has been noticed.

The results obtained by De Garmo with a method so simple and
easily performed, confirms the opinion I have so frequently expressed,
that the difficult and complicated operations requiring osteoplastic flaps
or bone sutures, are rarely, if ever, called for in the cure of femoral

hernia. The operation which I have used in the majority of my own cases is that of a single purse-string suture of the femoral canal, with kangaroo tendon. This method I have used in ninety of my cases, operated upon during the last fourteen years, without a single relapse. The method of Bassini, which is very similar to De Garmo's, I have used in 16 cases, and one case which I have considered a relapse, bears a striking resemblance to the case described by De Garmo, in which a

Fig. 7
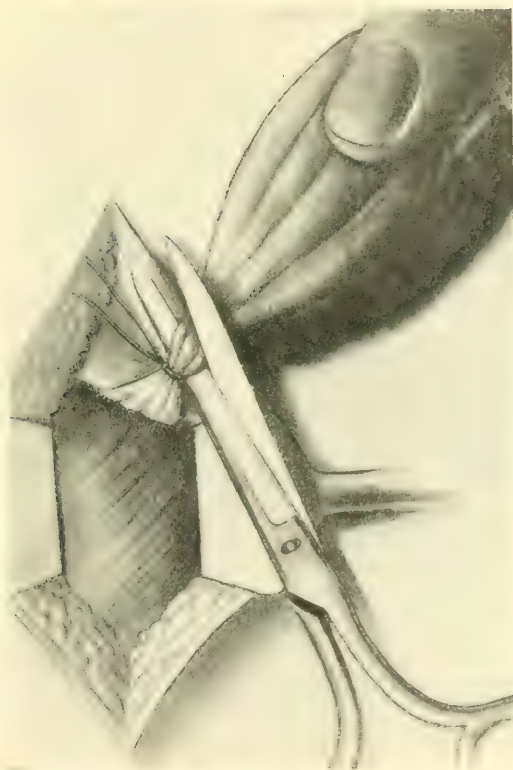
Sac forcibly drawn down while being ligated and cut away. This after examining its interior to see that no adhesions exist.

slight bulging occurred some months after operation, which, after wearing a truss for about a year, has remained well for seven years. The method of De Garmo and the one used by myself (purse-string suture) accomplish the same object in slightly different ways, and it is probably a matter of little moment whether the opening be closed by a single purse-string suture or by three or four interrupted sutures. The advantage of the purse-string suture is that it is more quickly applied

and seems to give equally satisfactory results. I always use an ordinary curved Hagedorn needle without a holder, although in going through the fascia lata overlying the femoral vein, a sharp needle must be used with the utmost care. A blunt needle would certainly be safer in the hands of one not familiar with the operation. Neither De Garmo nor myself has seen any evidence of undue pressure upon the femoral vein.

FIG. 8
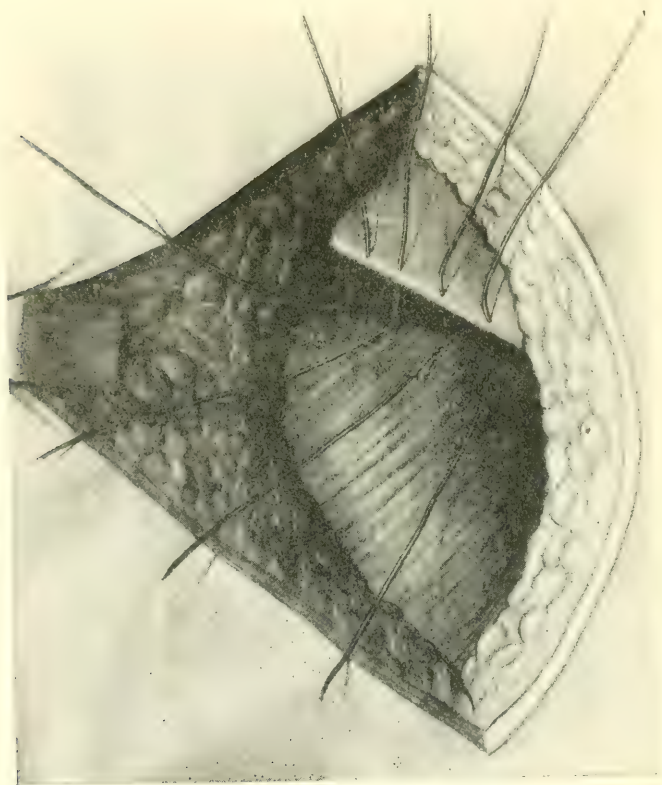
Showing sutures of kangaroo tendon passing through Poupart's ligament above and through all tissues to periosteum of ramus of pubes.

For De Garmo's first twenty-two operations braided silk was used in closing the opening; in three, silkworm gut, but in the last eighty-five cases, since November, 1896, kangaroo tendon has been used exclusively. De Garmo believes that at the present time kangaroo tendon approaches more nearly than any other the ideal suture for this purpose, in which opinion I heartily concur. Kangaroo tendon has been used in my entire series of cases since 1890.

Another operation for the radical cure of femoral hernia has recently been described by Polya.[1] The same is regarded, however, as suitable only in cases in which the sac is very large and the crural opening very wide. It has been performed with very satisfactory results in two cases. It consists in exposure of the upper part of the sartorius and of complete transverse division of this muscle at the junction of its upper

Fig. 9

Showing depression of Poupart's ligament to ramus of pubes by sutures tied down.

and middle thirds, the upper third being then turned inward, and its lower cut end inserted into the large crural canal, where it is securely fixed by deep sutures. This displaced portion of muscle is covered by a flap of deep fascia. Post mortem examination of the seat of operation in a patient who died four weeks after the same, it is stated, showed very close adhesion between the muscle and the crural canal and ring. Relapse in consequence of atrophy and yielding of the flap of sartorius

[1] Zentralbl. f. Chir., No 18, 1905.

is declared unlikely to occur, as the bloodvessels and nerves distributed to this muscle enter at its upper third, and so render this portion a very suitable flap for plastic purposes.

J. H. Nicoll, of Glasgow,[1] Scotland, describes a method for the radical cure of severe femoral and inguinal hernia. Its main features are given as follows: (a) The employment of the sac to form an intra-abdominal buttress over the internal aspect of the hernial opening or ring; (b) the use of the pubic ramus as a point d'appui in the process of closure of the hernial canal, and (c) the additional security of

FIG. 10
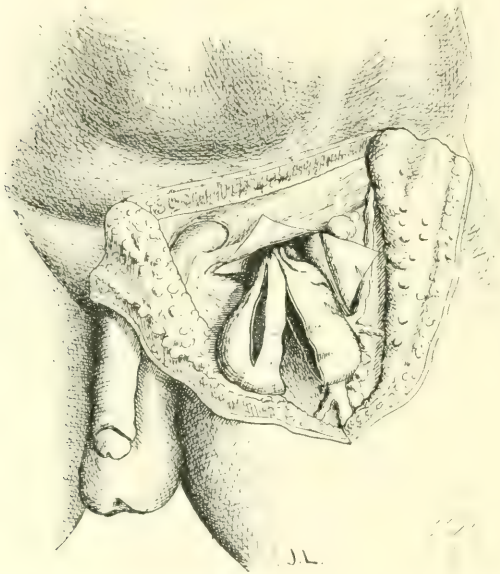
Sac emptied, detached from surrounding parts, including internal aspect of abdominal wall for one inch around femoral ring; split longitudinally, and one-half incised for passage of the other.

closure obtained by the superposition on the bone sutures of a plane of fascial sutures.

The application of this method to femoral hernia was described in the *British Medical Journal*, November 8, 1902, with a modification published in the *Scottish Medical and Surgical Journal*, December, 1903. Its employment in inguinal hernia was described briefly in 1905.

Nicoll states that in ordinary cases the method gives results as good, but no better, than many of the methods in use, but in severe cases with large hernial aperture of atrophy of the muscles, a much higher

[1] Annals of Surgery, January, 1906.

degree of security is obtained. The method originally designed for severe cases of femoral hernia he now uses in all cases, while in inguinal hernia he has as yet used it only in the very bad cases. The technique of the *operation for femoral hernia* he describes as follows:

(*a*) Obliteration of the sac, also of the peritoneal depression over the abdominal aspect of the ring, and the substitution of a buttress over the internal aspect of the ring:

1. Incise skin in vertical or transverse direction, expose sac and clear it from surrounding tissues.

FIG. 11
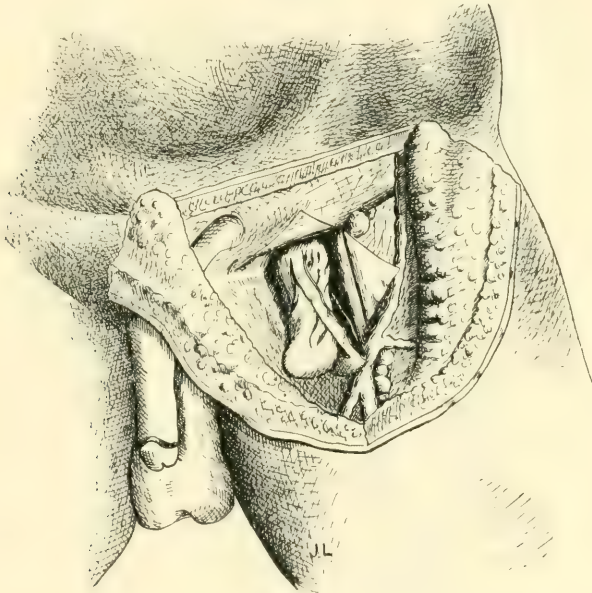
Sac ready for reduction, with halves interlocked. (The situation of the aperture in the sac in Figs. 10 and 11 and the relative positions of the two halves of the sac in Fig. 11 are not, in the interests of semidiagrammatic clearness in the drawings, quite those of actual practice.)

2. Open sac in its middle line and clear of contents.

3. Separate it from parts surrounding its neck, including the transversalis and the iliac fasciæ for one inch around the abdominal aspect of the ring.

4. Bisect the sac longitudinally from fundus to neck (Fig. 10).

5. Make an aperture in one half near the neck (Fig. 10).

6. Interlock the halves by putting the other through the aperture (Fig. 11). In certain cases it lies better if previously twisted one half-turn on its longitudinal axis.

7. Reduce the whole sac through the femoral ring into the extra-peritoneal space previously cleared for it by detaching its neck from the abdominal aspect of the ring. The sac thus lies bunched up within the abdomen, between the peritoneum and the transversalis and iliac fasciæ over the internal aperture of the femoral canal. (Where the sac is unnecessarily large, part of it may be cut away before reducing it through the canal.)

Fig. 12
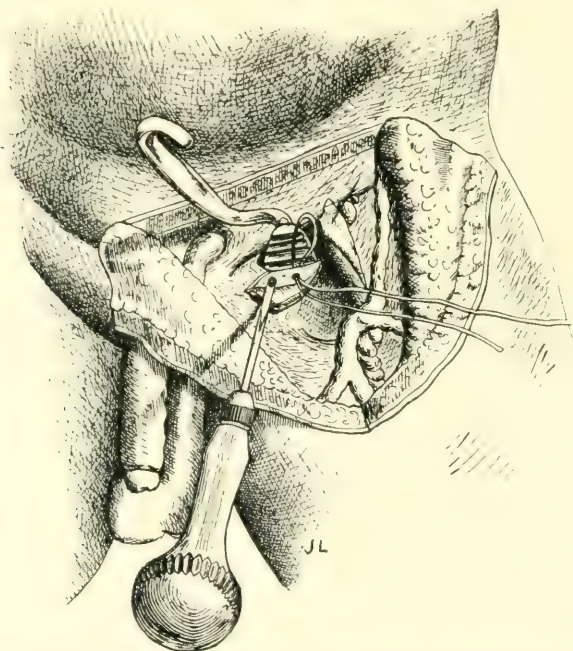
Closure of ring; drilling of bone; looped catgut suture passed through first drill-hole.

(*b*) Closure of the femoral ring:

1. Carry an incision (bone-deep) from the femoral vein along the pubic ramus to the region of the pubic spine. This divides the pubic portion of the fascia lata, the origin of the pectineus, and the periosteum. Its length will depend on the extent to which the femoral vein has been displaced outward by the presence of the hernia, and will vary from one to one and one-half inch.

2. Detach the periosteum to a limited extent and retract it.

3. Drill the bone near its upper edge in two places one-half inch to one inch apart.

4. Pass through one of the apertures a loop of stout catgut, or other absorbable ligature (Fig. 12). This, the author states, is most easily

passed by threading it in the eye of the bone-drill or in the eye of an ordinary surgical probe. He employs a special probe for the purpose, in which the eye is small and placed very near the extremity of the handle (Fig. 13).

5. Divide the loop of ligature. Thread one end in a large curved surgical needle and pass it as a mattress suture through Poupart's ligament. Unthread it from the needle (Fig. 13). Repeat this with the second end, carrying it through Poupart's ligament at a higher level (Fig. 13), avoiding the deep epigastric artery to the outer side, and, in male patients, the spermatic cord above. (In very large herniæ the

FIG. 13
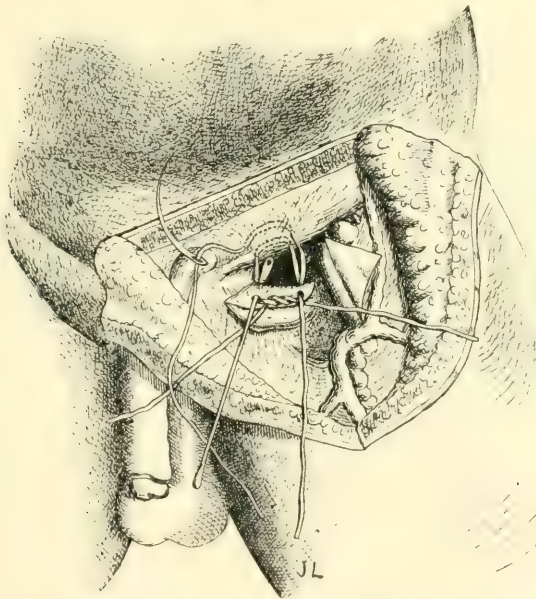
Closure of ring; placing of the loops in Poupart's ligament, and return of the ends through second drill-hole. (One loop tied loosely to indicate action in pulling Poupart's ligament down to posterosuperior aspect of ramus of os pubis.)

loops, instead of being placed the one directly over the level of the other, may be made to diverge in the ligament, so as to "gather in" the margin of the aperture.)

6. By means of the probe (into the eye of which the ends are threaded) withdraw both ligatures through the second drill-hole in the bone (Fig. 13). It is here that the special probe is of particular advantage.

7. Tie the ends of each loop separately over the front of the bone, thus bringing Poupart's ligament down to the posterosuperior surface,

of the bone and fixing it firmly in contact with that surface, constituting
what is in effect an extension outward of Gimbernat's ligament, and
absolutely closing the femoral ring to whatever extent may be desired,
due regard being paid to the amenity of the femoral vein. The degree
of occlusion is regulated by the position of the sutures in Poupart's
ligament, but not by the tension with which they are tied. This latter
does not vary, the knots being tied in all cases firmly to bring the liga-
ment into contact with the bone (Figs. 13 and 14).

8. To make the closure doubly secure, complete the operation by
uniting, by interrupted catgut sutures, the detached margin of the

Fig. 14
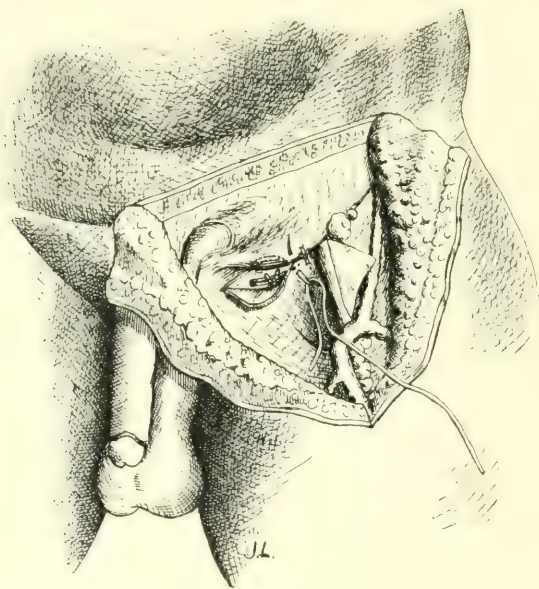
Closure of ring ; bone sutures tied ; completion of closure by suture of fascia lata and
pectineus to the fixed Poupart's ligament.

pectineal origin and the pubic portion of the fascia lata to the
" anchored " Poupart's ligament (Fig. 14).

Nicoll states that the absence of all sutures in the sac has three
advantages: The saving of time; avoidance of the risk of strangulation
and consequent sloughing of the sac; the facility with which the entire
sac may be placed within the abdomen.

Personally, I do not believe that there is any hernia, either femoral
or inguinal, in which the retention of the sac is of advantage in effect-
ing a radical cure. When treated by the older method of Macewen, it
not infrequently sloughed, thereby greatly increasing the chances of a

relapse, and when used after the manner of Kocher, the results are in no way superior to those obtained with Bassini's operation in which the sac is always removed on a level with the peritoneal cavity.

The chief original feature of Nicoll's operation is the method of closing the femoral canal. While in some ways it resembles Roux's operation for femoral hernia, Nicoll developed it entirely independently, and practised it before Roux's operation was brought out. In Roux's operation a metal foreign body, which in some cases may have to be withdrawn, at the risk of detaching the ligament from the bone. Nicoll accomplishes the same result by two mattress loops, or by making them diverge in Poupart's ligament, it is easy to effectually close the largest femoral ring without exerting pressure upon the femoral vein.

The technique of this method when employed in severe cases of *inguinal hernia* consists in

(*a*) Obliteration of the sac and formation of an intra-abdominal buttress, the sac being treated the same as described for femoral hernia, and finally placed over the internal aspect of the internal ring as a pad resting between the parietal peritoneum and the fascia transversalis.

(*b*) Closure of the inguinal canal.

1. With blunt retractors pull the spermatic cord (or round ligament) upward and Poupart's ligament downward.

2. Carry an incision along the superior aspect of the pubic ramus. This divides the iliac fascia, the origin of the pectineus, and the periosteum.

3. Slightly detach both margins of the periosteal wound.

4. Drill the bone near its upper margin, in two places, one-half to one inch apart. The drill-holes are situated somewhere between the pubic spine and the femoral sheath, their exact position varying with the shape and size of the hernial aperture.

Treatment of Undescended Testis. Temporary fixation of the testis to the thigh is an operation recommended by Keetley[1] for cases of undescended testis. The main incision is made over the inguinal canal and the external ring. Two other skin incisions are made in the great majority of cases, one one and one-quarter inches long at the bottom of the scrotum, and the other the same size in the upper and inner part of the thigh adjacent to the scrotal incision. Before cutting the scrotal incision a bed should be made with the finger in the scrotum to receive the testis and the scrotal incision should divide all the structures down to this bed. A blunt instrument, or a piece of gauze, should be passed through this scrotal aperture immediately, or its different layers will cease to be opposite

[1] Lancet, July 29, 1905.

one another.   The thigh incision should expose the fascia lata.   The
testicle and the cord having been thoroughly freed from everything but
the musculofibrous bands forming the gubernaculum, the latter is
divided as far away as possible from the testicle.   A pair of forceps is
then passed from below upward through the hole in the scrotum and
the gubernaculum is seized by it and pulled right through the scrotum
till it can be seen through the hole in the skin of the scrotum.   At the
same time the tunica vaginalis testis should be pulled down into the
scrotum, though it is not absolutely necessary to keep the testis in its
serous bag.   The posterior borders of the apertures in the skin of the
scrotum and thigh are next united by a continuous silkworm-gut suture
left long at both ends.   Then the gubernaculum testis is sutured with
strong catgut to the fascia lata of the thigh; and, lastly, the original

Fig. 15
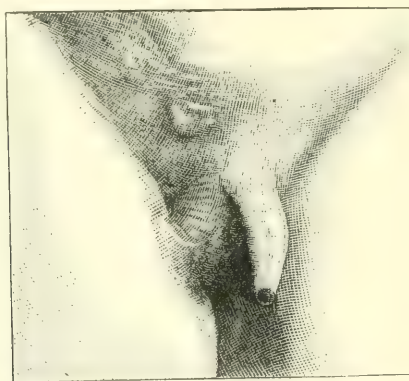
From a young man who had been operated on two years before for undescended testis
and right inguinal congenital hernia.   Being perfectly comfortable he did not wish the
testis to be separated from the thigh.

silkworm-gut suture is used to complete the union of the skin apertures
in the scrotum and the thigh to one another.   For the hernia, which
usually accompanies undescended testis, Keetley nearly always does a
Bassini operation.

The right side was affected in twelve of Keetley's cases; the left in
two; both sides in five; not stated in six.   The presence of a hernia was
noted in ten, but an unobliterated tunica vaginalis in the inguinal canal
was present in nearly all the rest.   The testis may, after a number of
weeks, be freed from the thigh under local anæsthesia.   Keetley states
that he leaves the testis attached to the thigh for five months.   It is
rare to find a patient who feels any discomfort.   The patient from
which the illustration is taken was operated upon two years ago and

feels no discomfort, although the testis has never been freed from the thigh, and Keetley states that he has several such patients.

Keetley's opinion that any surgeon practically acquainted with his plan would never afterward resort to any other may well be doubted. By the simpler method advocated by Bevan, by which a very large number of cases have been operated upon, both by Bevan and other surgeons, the testis cannot only be placed in the scrotum, but the cord can be lengthened and freed from all tension, so that it will permanently remain in the scrotum without any of the various methods of orchidopexy

Fig. 16
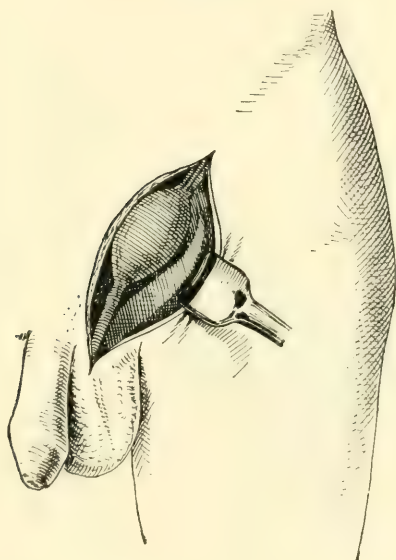
Formation of flap.

or the more complicated method advocated by Keetley. If quite as good results can be obtained by the simpler method, I see no reason for adopting the complicated one.

A new method of *Orchidopexy for Undescended Testicle* has recently been published by Carl Beck,[1] of New York. Beck says that "Retention of the testicle is a very frequent condition and deserves much greater attention than it generally receives; its dangers, such as fatty or fibromatous degeneration, as well as its tendency to inflammation, intumescence and strangulation, being considerably underrated. Its

[1] Medical Record, August 12, 1905.

great tendency to malignancy is illustrated by the cases of Kocher" and a number of other surgeons.

As regards the frequency of this complication, our statistics at the Hospital for Ruptured and Crippled show that undescended testis is found about once in every sixty cases of inguinal hernia in the male.

I believe that its dangers, both as regards inflammation and malignant degeneration, have been greatly overestimated. During the past sixteen years about eight hundred cases of undescended testis have been observed at the Hospital for Ruptured and Crippled, and yet there has been no example of either inflammation or strangulation; neither

Fig. 17
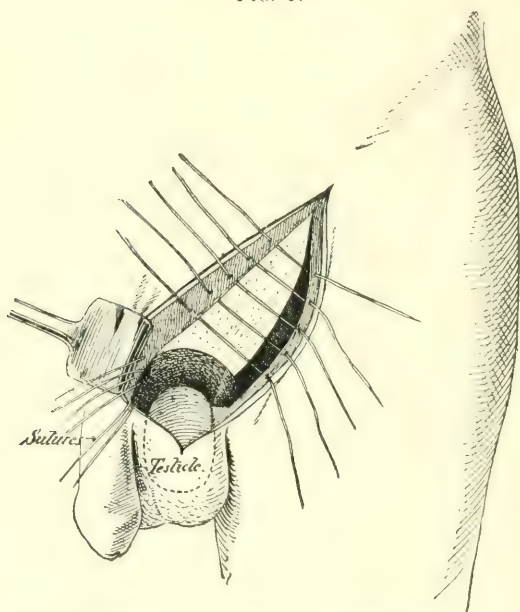
Testicle held down by inserting flap.

has a single case of sarcoma or malignant degeneration of the undescended testis been observed during this period. The elaborate paper of W. McAdam Eccles on " The Imperfectly Descended Testis"[1] confirms this opinion, not a single case of sarcoma of an undescended testis having been observed in 48,000 cases of hernia.

Yet that it does occasionally occur there is plenty of evidence. I have personally observed two cases, outside of the Hospital for Ruptured and Crippled, with sarcoma of the undescended testis.

The chief features of the operation offered by Beck consist in dissect-

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[1] Lancet, March 1 to 15, 1902.

ing a flap from the outer margin of the inguinal ring downward, which is turned in such a manner that it can be attached to the opposite layer in semilunar shape (Fig. 16). Beck states that this band surrounds the testicle like a necktie, the testicle being retained as in a buttonhole.

Personally, I believe that the operation advocated by Bevan,[1] of Chicago, two years ago, will give most satisfactory results in the treatment of this condition. If we carry out the main principles of Bevan's operation, namely, thorough freeing of the testis and cord well beyond the internal ring from all its attachments in the region of the external ring, it will be found, in most cases, to easily rest in the scrotum with-

FIG. 18
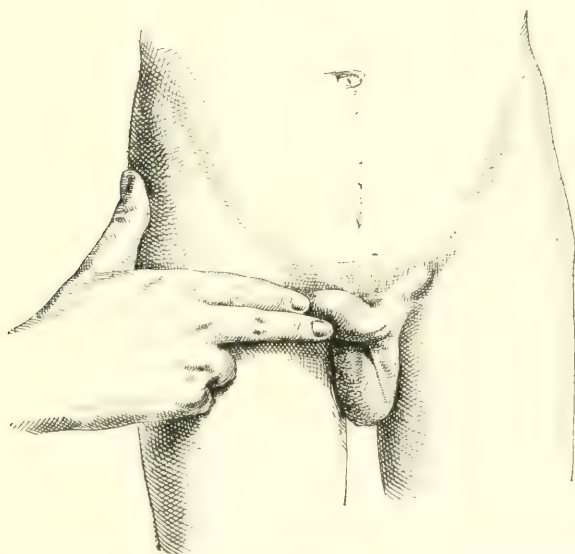
Scrotum containing the right testicle, the undescended testicle in the left inguinal region.

out any tendency to retraction, and hence there is little need for anything more than careful closure of the canal, particularly the external ring. Beck's method, however, is an ingenious procedure of furnishing additional security against retraction.

The Radical Treatment of Hernia in Children is discussed by E. Scott Carmichael,[2] of Edinburgh. He describes with considerable detail his experience derived from a series of 152 consecutive operations for the radical cure of hernia in children. The ages of the children ranged as follows: of males, 44 were under the age of one year; 67 between one and five; 22 over five years of age. Nineteen radical operations

[1] Journal of the American Medical Association, September 19, 1903, p. 718.
[2] British Medical Journal, February 3, 1906, p. 254.

were performed for the cure of inguinal hernia in the female. Carmichael, like Stiles,[1] of Edinburgh, who operated upon children below one year in 26 per cent. of his 360 cases reported, advises operation in very young children. He states that in children brought to the outpatient department within a week or two of birth, it has been customary to delay operation until the fourth, fifth or eighth month, for two reasons: (1) to enable the child to get a start in its feeding, especially if breast-fed, before admitting it to the hospital and weaning it; (2) because in seventy-five cases it was found to be advisable to circumcise it in order to facilitate the after-treatment; the skin of the infant after four months becomes harder and less liable to excoriation. He states that the age of choice for operation if a child is found at birth to be the subject of a hernia, and is at the same time healthy, may be set down at from four to eight months, before the appearance of the first dentition.

The reason he gives that a still larger percentage was not operated upon before the first year was that many of the children were not brought to the hospital until after that age. Thirty-three per cent. in males were operated upon under one year; fifty per cent. between one to five years, and seventeen per cent. over five years. Six cases were strangulated; five in children under the age of one year, the youngest being two weeks old, and in every one of these cases the hernia occurred on the right side.

As regards this position taken by Stiles and Carmichael, recommending operation in young infants, I believe that much more can be said against it than in favor of it. I think both writers have minimized the risks of operating upon such young children, and also fail to appreciate the fact that a very large percentage of these cases may be cured by mechanical treatment. While Carmichael has no deaths in the nonstrangulated cases, Stiles reported five deaths in 360 operations, a much higher death-rate than should obtain in cases operated upon after the age of four years. As I said a year ago, high authorities believe that 90 per cent. of children under the age of three years can be cured by truss. While, personally, I would not place the estimate quite so high, I believe that more than half of the cases under the age of three years are cured by truss and a much higher percentage under the age of one year. The risk of strangulation, which is admittedly greater in cases under the age of two years than after that age, must be considered, but to my mind such risk is more than offset by the higher mortality that would follow the practice of operating upon all cases under two years of age.

At the Hospital for Ruptured and Crippled we have operated upon

[1] See Progressive Medicine, June, 1905.

1700 children for the radical cure of hernia, their ages ranging between four and fourteen years. Of these cases only fourteen cases were strangulated, all of which were operated upon without mortality. Eight of these cases were under the age of two years.

These statistics show, in the first place, that strangulation is exceedingly rare under the age of two years; and in the second place, that when it does occur, there is a strong probability of our being able to successfully treat the condition by operation.

At the Out-patient Department of the Hospital for Ruptured and Crippled we treat about a thousand cases of hernia in children each year. In the great majority of the cases the hernia can be held in place without much difficulty by means of a well-fitting truss. If 50 to 75 per cent. of such cases can be cured by means of a truss, it would seem inadvisable to subject all these cases to an operation attended with a certain amount of risk.

Carmichael discusses at some length the various types of hernial sacs found in children. He states that of forty-four cases operated upon under the age of one year, the majority were seen within the first two months after birth, and he believes it extremely probable that in most of these cases the hernial sac was of congenital origin, and yet in these forty-four cases the sac was of the funicular variety in thirty-nine, while in only five was there a communication with the tunica vaginalis testis. A complete vaginal sac was found in only seven cases out of one hundred and thirty-three radical cures in male children. While most of the writers upon hernia describe a congenital hernia as one in which the sac communicates with the tunica vaginalis testis, I believe with Carmichael, that in many of the cases of the funicular variety the sac is of congenital or prenatal origin; yet there seems good reason to retain the older classification, inasmuch as we have no known method of distinguishing between a congenital and an acquired funicular sac. The frequency with which the cæcum and appendix are found in the hernial sac in young children is emphasized by Carmichael's statistics. In nine cases the cæcum and appendix were found in the sac; in three cases the bladder; in one the sigmoid flexure. The vermiform appendix was removed in seven cases.

It is somewhat remarkable that three cases of hernia of the bladder should have been found in one hundred and fifty-two cases. Carmichael states, however, that only one case could really be considered a true hernia of the bladder, as in the other cases it required more or less artificial manipulation during operation to bring the bladder into view.

At the Hospital for Ruptured and Crippled, in upward of 1700 cases, we have found the bladder but once in the hernial sac.

In eight of Carmichael's cases an encysted hydrocele of the cord was

complicated with a hernia. Carmichael states that it is always well, when an encysted hydrocele is present, to take it for granted that a hernial sac is present above it.

I think exception could be taken to this statement. We have a large number of encysted hydroceles of the cord at the Hospital for Ruptured and Crippled each year, nearly all of which disappear under external application of iodine or guaiacol. It has been found exceedingly rare for a hernia to develop in such cases. In a very few cases, perhaps three or four, we have seen a large encysted hydrocele of the cord gradually increase in size, get more and more tense, extend upward, until it finally communicated with the abdominal cavity. Probably in these cases there was originally a congenital funicular sac which had been closed near its upper end, and later a collection of fluid occurred in the lower portion. Tuberculosis of the sac was seen in four cases; the ovary and Fallopian tube were found in one case.

In discussing the origin of inguinal hernia in the female, Carmichael states that while Puech considers such inguinal hernia to be always due to a shortening of the round ligament, Lockwood believes the condition to be due to an abnormally long mesentery.

From my own experience, covering upward of three hundred operations for inguinal hernia in the female, I do not believe that either of the causes mentioned account for the condition. In none of my own cases was there any noticeable shortening of the round ligament, nor was there anything to justify one in assuming the presence of an abnormally long mesentery. The exceedingly intimate connection between the parietal peritoneum and the round ligament, which is seen in practically all cases, is to my mind a strong indication that in the majority of inguinal herniæ in the female we have a congenital funicular process of peritoneum, communicating with the abdominal cavity and inviting the formation of a hernia whenever the exciting cause arises.

A very serious condition rarely observed is that of *torsion of the pedicle of the adnexa contained in the sac of an inguinal hernia in young children.* Damianos[1] describes sixteen such cases, including one of his own, and adds five in which the pedicle was presumably incarcerated.

Damianos believes with Heegard that there is no "congenital" ovarioinguinal hernia, the latter claiming that while the sac in an inguinal hernia may be congenital, the contents never are. Damianos further holds that there is absolutely no analogy between the descent of the testicle through the inguinal canal and the eventration of the ovary into the sac of an inguinal hernia, the former being a retroperitoneal—the ovary an intra-abdominal organ with a free mesentery.

[1] Deutsche Zeitschrift f. Chir., November, 1905, vol. lxxx., Nos. 3 and 4.

As regards the etiology of torsion of the pedicle in adnexoinguinal hernia, Damianos bases his explanation upon Payr's theory, according to which, in small, pedunculated tumors with a comparatively thick and long pedicle, torsion may be produced as a result of "internal mechanical causes," namely, through the vascular system of the pedicle.

From the reports of Damianos it appears that torsion of the pedicle in adnexoinguinal hernia usually occurs during the first or early in the second year of life. There were only two exceptions to this rule in the sixteen cases reported, one of these being three, the other five years old. This is readily explained, he adds, by the fact that during the first or second year of life the ovary descends from the large into the small pelvis, its proximity to the abdominal inguinal ring ceases, and the chances of its entering a hernial sac decrease.

Damianos appends a table which shows that operation was performed within twenty-four hours after the symptoms of torsion set in, twice; within forty-eight hours, twice; between the third and fifth day five times; eight days later, in three cases; two to three weeks afterward, twice.

The adnexa were removed in all but one instance. All cases recovered.

While at the Hospital for Ruptured and Crippled, in about 300 cases of inguinal hernia in the female in children, we have observed several cases where the tube and ovary were present in the inguinal canal we have seen no case of torsion of the adnexa.

Hernia of the Female Pelvic Organs. Frank T. Andrews,[1] of Chicago, contributed a very valuable paper on hernia of the female pelvic organs, covering 366 collected cases, including a full report of four cases of hernia of the tube without the ovary, two of which are his own. Tabulating the cases, he found: 46 hernia of tube without ovary; 80 hernia of ovary and tube; 267 hernia of ovary without tube (or latter not mentioned); 43 hernia of non-gravid uterus; 30 hernia of pregnant uterus.

The four cases reported by Andrews are briefly as follows:

Case I. The patient, a woman, aged fifty-six years, had first noticed a small tumor in the groin fourteen years ago, after doing some heavy lifting while eight months' pregnant. The tumor was easily reduced and caused no further trouble until one and a half years ago, when it reappeared and was reduced with difficulty. Several attacks followed, each accompanied with increasing pain and vomiting, until in May, 1905, the tumor had become irreducible. Operation was performed at the Cook County Hospital, and the sac was found to contain a portion

[1] Journal of the American Medical Association, November 25, 1905.

of dark-colored ileum, a portion of broad ligament, and a loop of Fallopian tube, the ovary being situated within the abdominal cavity, but firmly pressed against the femoral ring and neck of sac. The tube and ovary were replaced, the sac excised, and the wound closed with catgut. The patient made an uneventful recovery.

Case II. Mrs. B. N., aged forty-five years. Family history entirely negative as regards hernia. Patient was a full-term child, and born in normal labor. She jumped from a high wall at seven and received a hernia in the left groin. Twelve years ago, while lifting a heavy weight, she received a hernia in the right groin. She consulted a doctor, who treated the hernia by injection, and discharged the patient as cured after a week's treatment. The right hernia recurred. Andrews first saw the patient in May, 1905, evidently suffering great pain. The hernia had been down four days and she was not able—as on former occasions—to reduce it. She had not menstruated for six years, a lapse which had never occurred before except in pregnancy. Examination showed a firm, round tumor the size of grape fruit, which could not be reduced to less than the size of a lemon. Diagnosis was made of hernia of the tube and ovary and enterocele in favor of incarcerated epiplocele (inguinal). Operation was advised and the patient removed to a hospital. The operation consisted of an incision parallel to Poupart's ligament; sac exposed and seen to contain light yellow-colored serum, was punctured and serum allowed to escape. The sac (peritoneal) was incised and the cyst wall was seen to be connected with one of the fimbriæ of the tube, all of which were in the wound. The fimbric end of the tube amputated. The hernia was femoral. The result was ideal, the patient leaving the hospital fifteen days after operation.

Case III. Mrs. K., aged fifty-two years, had had an inguinal hernia for sixteen years, caused by carrying pails of water. Operation revealed the usual condition of adhesion on both sides, except that the right tube led in a straight line to the hernia. About half of the tube was adherent, together with omentum in the hernial sac. The internal inguinal ring was patulous and a loop of bowel apparently slipped in and out of the sac readily. Removal of appendages and repair of hernia was done, followed by a normal recovery.

Case IV. Mrs. W., aged twenty-three years; first child born in March, 1905, since which time there has been great pain and tenderness in the inguinal region, where a tumor gradually developed. Diagnosis: pelvic abscess due to rupture of right pyosalpinx with adhesions to anterior abdominal wall. An incision four inches long was made in the median line. The pelvic organs on the right side were matted together and covered by adherent omentum and intestine. After

separating the omentum and bowel from the mass, the uterus could be seen drawn to the right. After separating some adhesions and drawing the uterus to the left, it was discovered that the right tube and ovary had been severed at the uterine horn. After a careful cleansing, an incision was made through the skin into the hernial abscess, and gauze drain inserted. Another drain was inserted in median incision and the remainder of the wound closed. The patient made an uninterrupted recovery.

Andrews further gives a brief resume of the forty-six cases of hernia of the tube without hernia of the ovary, twenty-seven of which were inguinal, fourteen femoral, two obturator, and three not stated.

An analysis of the *inguinal herniæ* shows eleven to have been acquired, twelve congenital, and three not stated. The ages of the patients ranged between birth and forty-six years. One was a double hernia. Seventeen of the twenty-seven inguinal herniæ recovered after operation; three died; in five the hernia was found postmortem, and in two the result is not stated.

The tube alone was found to be the contents of the sac in twenty-three cases; tube and intestine in two; tube and omentum and tube and part of bladder in one each. In eleven cases the sac contained fluid.

Of the *femoral herniæ* ten were acquired; one congenital, three not stated; ten recovered after operation; two died; one was found post-mortem, and one not stated. How it can be determined whether a femoral hernia or an inguinal hernia in the female is congenital or acquired I do not know.

The tube alone was contained in the sac eleven times, tube and omentum once; tube and epiploon once; tube and part of bladder once. In seven cases the sac contained fluid. The ages of these patients ranged between thirty-six and seventy years.

The two cases of *obturator hernia* occurred in patients seventy-three and seventy-eight years of age; the hernia was found postmortem and the sac contained the tube in both cases.

Andrews states that *hernia of the Fallopian tube*, without the ovary has been found to constitute about ten per cent. of the published cases of hernia of the pelvic organs.

Hydrocele in the Female. Halstead and Clark,[1] of Chicago, report a case of this condition. The patient was admitted to the hospital on a diagnosis of strangulated hernia. The fact that it was not a hernia was not recognized until she was anæsthetized. A tumor a little larger than an egg, oblong in shape, was found in the right inguinal.

[1] Annals of Surgery for May, 1905.

region. It was irreducible, tense, elastic, and very tender. On opening the tumor one and one-half ounces of pale, straw-colored fluid was removed. The sac was freed from the surrounding tissue and from the round ligament with which it was intimately connected, ligated at its highest point and removed. The wound was closed as in the ordinary Bassini operation for hernia. The sac was bilocular, being divided by the internal abdominal ring into an upper and lower sac. The upper sac lay entirely within the peritoneal cavity. The patient stated that the tumor could be reduced up to within a week prior to the operation. There had probably been a communication between the lower and upper sacs, so that the fluid could be made to enter the upper sac, which was continuous with the peritoneal cavity.

The writers refer rather briefly to the literature of hydrocele in the female, giving five varieties as described by Rignoli, and quote the results of the investigations of Sachs and Niemann upon the female cadaver, the former finding a patulous canal of Nuck or funicular process of peritoneum in thirty-seven out of one hundred and fifty; the latter in twenty-eight out of forty-six. They state that three similar cases are reported by Chiari.

The condition under consideration is by no means as rare as the writers assume. Fourteen years ago, in the *Annals of Surgery*, July, 1892, I published a paper upon hydrocele in the female and reported fourteen cases personally observed at the Hospital for Ruptured and Crippled, together with one previously observed at the New York Hospital. Since that time a much larger number have been observed and treated at the Hospital for Ruptured and Crippled. At the time of my paper Wechselmann[1] had collected sixty-two cases in the literature. To this collection I was able to add thirty, including fourteen personal cases.

Of the sixty-two cases collected by Wechselmann, twenty-two were treated by operation, the sac being excised in most cases. There were two deaths. The remainder were treated by aspiration, with the injection of iodine or some similar substance or by simple incision.

Of the thirty additional cases that I collected from the literature, twelve were treated by operation; eighteen by aspiration or aspiration with injection of iodine or carbolic acid. Of the eighteen treated by aspiration and injection, nine recurred.

In the paper referred to I stated: "The common method of aspiration and injection is not only unscientific, but attended by some risk, and I strongly advocate radical operation with excision of the sac."

[1] Arch. f. klin. Chir., 1890, Bd. xl., 578.

SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA.

By EDWARD MILTON FOOTE, M.D.

THE ABDOMEN IN GENERAL.

Contusions of the Abdomen. If the expectant treatment is indefensible after open wounds of the stomach it is also risky in contusions of the abdomen in which there is pain, tenderness, and muscular rigidity. J. Y. Brown[1] cites a case in which one might well be puzzled to know the outcome without opening the abdomen. A Greek laborer, aged 49, was run over by a wagon, the wheels passing across the abdomen. Within an hour he was brought to the hospital suffering from shock, with signs of internal hemorrhage. No bones were broken, and the urine drawn by catheter was free from blood. There was great tenderness and muscular rigidity over the entire abdomen, and pronounced dulness in the region of the spleen. Hypodermoclysis and external heat were employed. The patient reacted well and for five days gave indications of recovery. Meanwhile a tumor was made out in the region of the spleen. At the end of five days, there were sudden symptoms of internal hemorrhage. The abdomen was opened two hours later. The peritoneal cavity was filled with blood from a laceration in the spleen. This was tamponed with gauze, and the abdomen flushed with hot saline solution, but the patient did not rally from the loss of blood. Brown feels certain that prompt surgical intervention would have saved this patient.

Penetrating Wounds of the Abdomen. R. Winslow[2] insists that penetrating stab and shot wounds of the abdomen, occurring in civil life, should be considered a sufficient cause for operation. This principle, he says, has been so fully established that one is no longer obliged to apologize for the performance of laparotomy, but is under the necessity of defending himself if he fails to give his patient the benefit of an operation. He reports a series of 29 cases. In five, no operation was performed. The mortality was 80 per cent. The mortality after operation, in the remaining 24 cases, was 37.5 per cent. There was perfo-

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[1] Journal of the American Medical Association, 1905, xliv. p. 702.
[2] Ibid., lv. p. 1048.

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ration of some hollow viscus in 20 of these cases. The mortality, after operation, in these cases alone, was 45 per cent.

While the above rule of immediate operation is pretty generally recognized for gunshot wounds of the abdomen in civil life, there are some who hesitate to open the abdomen after a stab wound, unless there is a pretty strong probability that some hollow organ has been opened, or there is smart hemorrhage. This is, of course, a weak position, the only possible excuse for taking it being the fact that a good many patients who have been stabbed in the abdomen recover if not operated upon. They are for the most part patients without serious hemorrhage, and without complete perforation of a hollow viscus. Without operation they run a fearful risk of secondary perforation of a badly wounded stomach or intestine. Two of Winslow's cases were of this class. In all he operated upon seven patients with stab wounds of the abdomen, with seven recoveries. One case was a remarkable one. An Italian, aged twenty-one, was stabbed in the right side and rode some distance to a physician's office, carrying his intestines in his hand. The physician enlarged the wound, returned the intestines and sewed up the skin, sending the patient by rail 36 miles to a hospital. There, 24 hours later, the abdomen was opened and washed free from blood and foreign material and drained. The patient recovered rapidly.

GUNSHOT WOUND OF THE ABDOMEN. J. H. Iden[1] reports a case of prompt laparotomy for gunshot wound of the abdomen which is a beautiful illustration of what prompt and correct operation will accomplish. The patient was a young Japanese who was shot with a 0.32 calibre revolver. The abdomen was opened a little less than five hours after the accident, and nineteen perforations of the small intestine and several others of the mesentery were repaired. One short resection of small intestine was necessary. Eventration was unavoidable. Hot saline solution was used for cleaning the peritoneum. The patient made a prompt recovery, the highest temperature being 100° F., and from the fourth day the temperature was normal. The intestines at the time of injury were moderately full.

PISTOL SHOT WOUND OF STOMACH AND SPINAL CORD. In a case of this injury reported by J. C. Pegram, Jr.,[2] the abdomen was promptly opened and two wounds in the stomach closed by purse-string and Lembert sutures. A bleeding vessel in the mesocolon was ligated. The patient, a woman aged twenty years, in the days following this operation developed symptoms of transverse myelitis. Radiographs in two diameters showed the bullet, 0.38 calibre, lying in the spinal canal. Nineteen days after the shooting the spinal canal was opened from the

[1] Medical Record, 1906, vol. lxviii. p. 817.
[2] Annals of Surgery, 1905, vol. xlii. p. 83.

twelfth dorsal to the second lumbar vertebræ inclusive and the bullet removed without difficulty. The spinous processes and long spinous ligament of these vertebræ were preserved by splitting them longitudinally and dividing one half of the spinous ligament above the twelfth dorsal and the other half below the second lumbar and reflecting these flaps before cutting the laminæ. At the time of report, six months after operation, the paralysis had so far decreased as to permit the patient to walk and to retain her urine.

Fracture of the Pelvis and Rupture of the Internal Iliac Artery. Athanasescu[1] relates how by a prompt operation he saved the life of a patient who was crushed between two casks. The hemorrhage infiltrated all the tissues about the internal iliac artery, and was only controlled by the ligature of this vessel. There was also a fracture of the os pubis. Artificial serum was injected to combat the profound shock. The patient recovered with slight deformity of the pelvis.

Complications after Laparotomy. PNEUMONIA. Kelling[2] gives as predisposing factors of pneumonia after laparotomy, age, alcoholism, cancerous cachexia, weakness of the heart, emphysema, long-continued dorsal decubitus, and such nervous causes as pain, vasomotor stasis and cooling of the body. These patients have a predisposition to pulmonary stasis, especially in the right lower lobe. The infective agents enter the lungs through (1) the air, (2) the blood, (3) the lymph.

1. *Aspiration pneumonia* may result from material drawn into the lungs from the mouth or nose, or, after vomiting, from the œsophagus or stomach. In case of bronchitis sputum may be aspired from one part of the lungs to another. This is especially dangerous.

2. *Embolic pneumonia* develops from thrombi formed in the veins of the stomach, uterus, etc., which are radicles of the vena cava; or in those of the retroperitoneal veins which are connected with the mesentery by lymph channels (suppurative processes and strangulated hernia).

3. Lymph vessels lead directly through the pleura, so that when the lung is œdematous from stasis a pleurisy may become a pneumonia. Other lymph vessels which penetrate the diaphram may lead to sepsis, hypostasis and lobular inflammation and thrombosis in the lungs.

Infection from the air is more important in laparotomies than in other wounds. The way to avoid postoperative pneumonia is to avoid infection of the abdominal organs, mesentery and peritoneum. Excluding aspiration pneumonia, postoperative pneumonia is more or less frequent according to the greater or less frequency of infection.

Czerny[3] reported fifty-two cases in 1300 laparotomies. They were more

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[1] Spitalul, 1905, vol. xxv. p. 80.
[2] Verhandlung der deutschen Gesellschaft für Chirurgie, 1905, Bd. ii., S. 136.
[3] Ibid.

common in stout persons. Aspiration pneumonias are favored by suture of the wound, presumably because the pain in deep breathing and coughing leads the patient to avoid expectoration. Of the fifty-two cases of pneumonia fourteen followed operations on the biliary tract, twelve followed resection of the stomach, twelve, after gastroenter-ostomy, and two, after operations on the female pelvic organs.

The limited action of the diaphragm explains the first three groups of these cases: possibly the elevated pelvis during operation may ex-plain the last group. Thirty-one patients recovered, twenty-one died in spite of a clean field of operation. As prophylaxis he advised pre-paratory treatment of the mouth, bronchi and careful asepsis.

Trendelenburg's statistics showed that 5 per cent. of laparotomy patients had pneumonia. The figures for individual lesions and opera-tions are as follows: Gastrostomies, 3 per cent.; biliary tract, 6.4 per cent.; severe contusions, 15 per cent.; appendicitis, 5 per cent.; ex-ploratory laparotomy, 4.7 per cent.; female pelvic organs, 2.8 per cent. There were in all eighty-five patients, of whom fifty-two, equal to 60 per cent., died.

Kausch emphasized the importance of prophylaxis—keeping the patient warm by wrapping the extremities, and by hot irrigation and emptying the stomach.

Krönlein reported a pneumonia percentage of 5.6 after laparotomy in 1409 cases. One-half of the pneumonic patients died. He believes that many cases may be avoided by the most careful attention to de-tail, such as those mentioned above, also by using the smallest possible quantity of the best anæsthetics.

Bibergeil[1] recommends the following prophylactic measures: cure of the bronchitis before operation; preoperative cleansing and disinfecting of the mouth and throat; gastric lavage before operation upon the stomach or intestines; an empty stomach. During operation the head should be kept to one side and mucus allowed to escape outward, and chilling of the patient avoided. All solutions should be thoroughly warm. After operation the position of the patient should be changed frequently, and occasional deep breathing encouraged.

PHLEBITIS AFTER ABDOMINAL OPERATIONS. Cordier[2] says that this complication occurs in about two per cent. of all abdominal operations. This is a surprising statement, but is based on the reports made to him by thirty well-known American surgeons. He was able to collect records of 232 cases of phlebitis after operation, and in ninety per cent. of these cases the left femoral or saphenous vein was affected. The anatomical cause for this is not clear. Keen has suggested that the

[1] Arch. f. klin. Chir., 1905, vol. lxxviii. p. 339.
[2] Journal American Medical Association, 1905, vol. xlv. p. 1792.

passage of the left common iliac vein behind the right common iliac artery might retard the blood current and thus lead to a thrombosis.

There was no case of gangrene of the limb among these 232 cases. The fatality, as seen by the table below, was also slight; but complete recovery was retarded very frequently, and for months many of the patients were troubled with poor circulation in the affected extremity. Treatment consists in elevation of the limb, moist compresses loosely bandaged to the thigh, and the internal administration of cathartics and tonics. Massage and manipulations are dangerous in the early stage of the affection.

Cordier found that phlebitis followed the various abdominal operations as follows:

Nephrorrhaphy	9
Appendicitis, usually so-called aseptic cases	27
Cholecystotomy	4
Oöphorectomy	16
Hysterectomy for fibroids, so-called aseptic cases	69
Vaginal operations, various sorts	8
Alexander's operation	3
Hernia	4
Pyosalpinx	7
Pelvic operations, not specified	9
Abdominal and pelvic, not specified	56
Ectopic pregnancy	4
Vaginal hysterectomy for cancer	9
Suspension of uterus	7
Splenectomy	1
Total	232

The following special features were noted: In 213 cases the left saphenous or femoral veins were affected; in 8 cases both left and right veins were affected; in 11 cases right veins alone involved; in 182 cases proximal part of vein first noticed; in 36 cases distal part of vein first noticed; in 166 cases sepsis was not present at time of operation; in 10 cases pus was present at the time of operation; in a large majority of the cases the first symptoms were noted from the tenth to the fifteenth day; in 6 cases pleuritic or pulmonary complications were present; in 3 cases sudden death occurred.

In discussing this paper, Thienhaus said that it has been his practice for four years past to put in the Trendelenburg position immediately after operation any patient whose veins he fears may become thrombosed. This position is maintained from eight to fourteen days. He believes that thrombosis can always be avoided in this way.

Diagnosis and Operative Technique. The Pieseometer. An instrument to measure abdominal rigidity has been devised by T. W. Kilmer.[1] Its

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[1] Medical News, 1905, vol. lxxxvii, p. 1013.

use will enable the surgeon to determine with accuracy, and to record the resistance offered by the abdominal wall. The amount of resistance offered by different abdominal walls varies greatly, so that one cannot speak of a normal amount of resistance to which all shall be compared. It is possible, however, as Kilmer has shown by six months' test of his instrument, to say whether a given abdomen is more or less resistant than it was at a previous examination. The pieseometer consists of a delicately tempered spring, concealed in the handle of the instrument (Fig. 19). This spring is accurately gauged, so that the number of

Fig. 19

pounds pressure which it requires to press the knob-end of the instrument a given distance into the abdominal wall, is definitely shown. This knob is usualiy set at a distance of one-half inch from the large disk. In very fleshy persons it may be necessary to increase the distance. The only precaution in using the instrument is to see that the knob is set at the same distance each time that the instrument is employed on the same person. If it is set, for example, at half an inch, and it is found on successive tests that at first two pounds of pressure are required to press the disk to the level of the skin, and later, two and a half pounds, and still later, three pounds, the proof is conclusive that the resistance of the abdomen is increasing, and that the abdominal muscles are becoming more tense. The instrument should be warm when placed in contact with the skin.

Kilmer's pieseometer, one-half natural size.

Exploratory Incisions. Cumston[1] treats of this subject, especially its performance in cases of suspected malignant disease. He says that an "exploratory incision is not to be undertaken lightly, but when it is required every possible precaution should be taken. The operation should be conducted with as much rapidity as is consistent with careful manipulation, and loss of blood should be carefully controlled. When the abdomen contains malignant disease the slightest rough or unskilled handling will cause the blood to ooze from many small points which cannot be ligated, or, on the other hand, if the growth itself should be lacerated, the hemorrhage may really be severe. It should always be recalled to

[1] St. Paul Medical Journal, May, 1905.

mind that the blood of soft malignant neoplasms flows through channels deprived of any muscular structure in their walls, which, consequently, are unable to contract and retract like normal bloodvessels. Then, again, the blood itself is thin and watery, and has little tendency to clot, and, for this reason, a fairly good-sized incision is to be preferred, so as not to blindly feel around in the abdominal cavity."

TRANSVERSE INCISIONS. A. E. Rockey[1] has used the transverse abdominal incision for over two years almost exclusively, and is more and more convinced of its superiority. The natural transverse wrinkles in the skin of the abdomen represent the lines of least tension and greatest elasticity. Hence incisions made in the skin following these lines require fewer and finer sutures, healing is more prompt and there is no tendency toward spreading of the scar. The cutaneous incision is made through the skin and fat to the aponeurosis of the muscles. The skin and fat are then drawn forcibly upward, such dissection as is necessary being performed with the finger, or a few snips of the scissors. From that point onward, the customary incisions are employed, vertical in the linea alba, and through the rectus muscle, intermuscular separation to expose the appendix, etc.

THE PERITONEUM.

General Peritonitis. The *treatment of peritonitis* was one of the six subjects considered by the International Society of Surgery, at its first triennial congress held at Brussels, September 18, 1905. About five hundred surgeons from all over the world were present. Frederich,[2] of Leipzig, who opened the discussion, called attention to the fact that peritonitis is not one disease, but many, and that the prognosis in a given case depends largely upon the character of the exciting organism. He recognizes only one contraindication to operative treatment, namely, the existence of symptoms which indicate the paralysis of the bulbar centres (cyanosis of the extremities, coldness, imperceptible pulse). The anaesthesia which he prefers is a little ether and subcutaneous injection of small doses of morphine. The patient should be kept warm by artificial means during the operation. Evisceration and peritoneal lavage he does not advocate, and only performs enterotomy when the distension is very great. The postoperative treatment consists in gastric lavage, early defecation, the injection of large quantities of fluid, and the subcutaneous injection of olive oil.

Krogius, of Helsingfors, reported upon ninety cases of " generalized

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[1] Medical Record, 1905, vol. lxviii. p. 779.
[2] Rev. de Chir., 1905, p. 545.

peritonitis starting from the appendix," which have been operated upon
at his clinic since 1901. There were 78 per cent. of recoveries among
the thirty-two patients who came to operation in the first thirty-six
hours; 42 per cent. of recoveries among the thirty-one patients who
were operated upon between thirty-six and seventy-two hours, and only
12 per cent. of recoveries among the seventeen patients operated upon
after three days. He is an advocate of Mikulicz drains variously
placed, including drains in the lumbar region or in Douglas' pouch.

Lennander, of Upsala, said that the intestinal paralysis might be
combated by numerous enterotomies made during the operation, the
openings to be straightway closed by suture. His preference, however,
is for a permanent opening in the cæcum or small intestine. He even
went so far as to say that a paralyzed small intestine should be resected,
up to a portion measuring a metre in length. The remaining ends
should then be united by suture and an enterostomy opening be estab-
lished as a precaution above the line of anastomosis.

TREATMENT OF PARALYZED INTESTINE. K. Dahlgren[1] believes in
emptying the paralyzed intestine as thoroughly as possible in operating for
general peritonitis. He draws a distended coil of intestine out of the
wound and makes a transverse incision half an inch or more in length
(1 to 1.5 cm.).

This is held open by clamps and the adjacent intestine both above
and below is emptied by "milking" it between the fingers of each hand.
Then the next more distant loop is emptied through the same incision,
and so on till the whole small intestine from duodenum to ileocecal
valve has been thus treated, and can be readily replaced. He has de-
signed an instrument for this "milking," which is a loop spring, on the
bent end of which are two metallic cylinders. Dahlgren also employs
gastric lavage, enemata and laxatives by mouth and rectum, and lately
has seen energetic peristalsis excited by the sulphate of atropine given
hypodermically, using one mgr. ($\frac{1}{60}$ grain) in each four or five injections
if necessary. He reports fifteen patients treated for general peritonitis
by the above-mentioned operative and medical measures with seven
recoveries.

The technique of *enterotomy* under these circumstances has been still
further developed by A. Wolf.[2] In the article in which he describes it
he advocates it for ileus and not for peritonitis, but the method of oper-
ating is applicable in either case. He says that *enterotomy for ileus* is a
form of treatment that is becoming generally recognized as desirable in
many cases. If the obstruction is low down, as in volvulus of the sig-
moid, much of the obstructed fecal material can be washed out through

[1] Centralbl. f. Chir., 1905, p. 394.   [2] Ibid., p. 1234.

the rectum after the obstruction is relieved. If the obstruction is higher up, this method is not of much service, and enterotomy is necessary.

He proposes a method which preserves asepsis. The loop which is chosen for incision may or may not be brought out of the wound. It is clamped, an oval purse-string suture is inserted, and a short incision made in its centre, through which a large rubber tube is pushed upward toward the stomach.

The suture is drawn tight to prevent leakage. The clamps are removed from the intestine, and the fluid intestinal contents are expelled through the tube into a suitable receptacle.

An assistant then slowly withdraws the tube and the purse-string suture is drawn tight and tied. Additional Lembert sutures are inserted if needed. This technique is feasible, even though the loop chosen cannot be drawn out of the abdomen. The tube can be utilized before its withdrawal for the introduction of fluid nourishment or saline solutions.

Turning again to the speakers at the Congress we find Lejars, of Paris, holding similar views. The most that we can hope to accomplish by treatment is to aid in the development of a reaction, which is so essential for the defence of the organism. We know that there are many varieties of peritonitis, but our knowledge thus far is not sufficient to be of much service in treatment. For clinical purposes, therefore, it is best to make three classes of peritonitis, dividing the cases into those in which the infection is above the omentum, originating from the stomach, duodenum or liver; those in which the infection is below the omentum, originating most frequently from the appendix, and those in which the infection, either ascending or descending, passes from the area in which it starts to the other area. Immediate operation is indicated in all cases of perforation, traumatic or pathologic, of the alimentary tract, and no less so in cases of ileus, partly on account of the impossibility in making an exact differential diagnosis. Operation has two objects: the removal of the source of infection, and the disappearance of the infection itself, which has already spread over the serous surfaces to a greater or less extent. There is little difference of opinion in regard to the accomplishment of the first object. Lejars advocated lavage of the abdomen in cases of widespread peritonitis without adhesions. His usual treatment is to employ drains, and enterotomy or enterostomy for meteorism; to evacuate the bowels by injections of olive oil, or solutions of sulphate of soda; to place the patient in Fowler's position.

McCosh,[1] of New York, took a somewhat more conservative view. His conclusions in regard to treatment are taken from an article published by him two months after the Congress.

[1] Medical News, 1905, vol. lxxxvii. p. 865.

1. No one plan of treatment is applicable for all cases.

2. The majority of cases are best treated by operation, but there are also many cases in which operation diminishes the chances for recovery.

3. Undoubted cases of general peritonitis recover without operation.

4. Rapidity, gentleness and removal of the cause are the most important features of the successful operation.

5. Irrigation with saline solution is generally recommended. All chemical and mechanical irritants are to be avoided.

Fig. 20
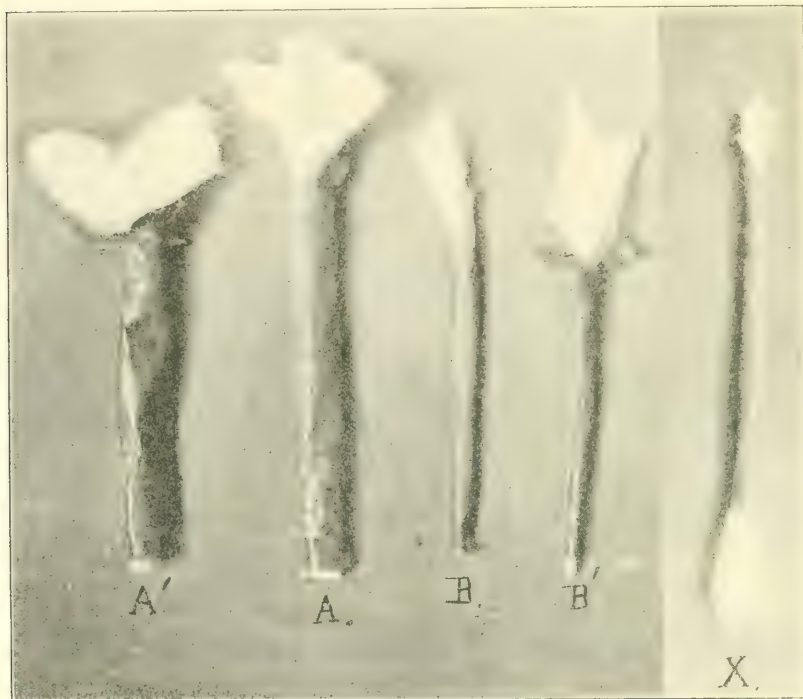
Cigarette drains: *A* and *B*, before introduction. *A'* and *B'*, after introduction; upper ends unrolled into the dressing. *X*, badly constructed drain, gauze rolled too tight and at lower end fringy and projects too far. (McCosh.)

6. Drainage should be provided, but the drains should be smooth, non-adhesive and of small diameter. The cigarette drain is preferred.

7. Enterostomy is not advocated.

8. Gauze packing is injurious.

9. Fowler's position after operation is most advantageous.

He is an advocate of the cigarette drain, when properly made (Fig. 20).

E. de Isla, of Madrid, does not believe that all cases should be treated by operation. Medical treatment consists in hypodermic in-

jections of morphine and atropine, in absolute repose, ice externally and subcutaneous or intravenous injections of physiologic serum, to which has been added pure oxygen. He injects from 800 grams to 1 litre (1 quart) of this serum in the buttocks.

Dudgeon and Sargent reported upon 270 cases of *acute peritonitis* in which they had studied the bacteria. The bacillus coli is, of chief importance and is responsible for most of the deaths. Peritonitis, due to streptococci, is more uniformly fatal, but is of rarer occurrence. If streptococci are present, peritoneal lavage should be employed, as it should if the pyocyaneus is present, as it is in rare instances. If the infection is due to the coli bacillus, lavage should never be used, but the coils of intestine within view should be wiped with dry gauze. This statement is based on the observation of thirty-three cases. Twenty patients were treated by evisceration and lavage; and nineteen died; while thirteen were treated by sponging with dry gauze and ten recovered. Drainage should be used for encysted peritonitis, but not for generally diffuse peritonitis. Purgatives should be employed. Opium, morphine or other similar drugs paralyze the intestine and reduce phagocytosis and are harmful.

The indiscriminate use of antitoxic sera in peritonitis, without regard to the bacteriology of the individual case, is to be deprecated as being as useless as it is unscientific.

In the large majority of cases of acute peritonitis it is the colon bacillus which kills the patient. This can at least be determined by coverslip preparations and cultures taken at the operation. The hope for the future lies, therefore, in the development of multivalent anti-bacillus coli serum. There is at present no such serum, but experimenters are endeavoring to produce it.

In a short paper on *general peritonitis due to perforative appendicitis* Mayo Robson[1] advocates free irrigation of the peritoneal cavity during operation, with normal saline solution, and free drainage by large rubber tubes enclosing gauze strips. As death is due to toxaemia from absorption through the peritoneum, to delay operation is to court disaster. If operation is performed before a fatal dose of poison has been absorbed, the cause may be removed; and the septic material washed from the peritoneal cavity.

When this is done a good percentage of recoveries is to be looked for. Should there be serious distention of the intestine and threatening paresis, a dilated loop should be brought out of the wound and transversely incised. The other loops may then be " milked" of their gas and fluid contents by stripping between rubber covered fingers.

[1] British Medical Journal, 1905, vol. ii. p. 15.

The opening in the empty intestine is then closed. If paresis is far advanced, a drainage tube may be left in the cæcum until the latter regains its tone.

Young[1] has made an attempt to secure for comparison the experiences, methods and opinions of fifty American surgeons, in order to advance our knowledge of *acute diffuse suppurative peritonitis.* The weak points in this method of compilation are apparent to anyone, and probably most of all the one who makes actual trial of the method. Young received twenty-five replies to his queries, which were:

1. Do you make it a rule to operate on acute diffuse suppurative peritonitis?

2. If not, what are the contraindications?

3. On how many cases have you operated, and with what mortality?

4. What is your method of operation and treatment?

5. Do you ever refuse to operate, and if so, when and why?

The answers to questions 1, 2 and 5 showed that the surgeons were almost a unit in favor of operation, if the patient was not moribund. The mortalities given by the various writers ranged from 4 to 80 per cent. In regard to methods of treatment, fifteen expressed themselves in favor of irrigation and ten against it. The Fowler position was advocated by seventeen.

Young's conclusions are:

1. Early operation, the diagnosis being made before shock appears. Murphy gives the early symptoms in the following order: pain, nausea and vomiting, localized tenderness, circumscribed flatness on piano percussion, elevation of temperature, and hyperleucocytosis.

2. Simple incision with simple drainage, placed in pelvis and such other fossæ as seem to require it. Perforations should be closed and an offending appendix removed, provided these things can be done without too great handling of viscera.

3. The Fowler position to retard lymphatic absorption.

4. Physiologic salt solution by rectum, one and one-half pints every two to four hours, for twenty-four to forty-eight hours.

5. Antistreptococcic serum in suitable cases in the hope of combating the effect of toxins absorbed.

SALINE INFUSION IN GENERAL PERITONITIS. In speaking of the treatment of a patient with perforated ulcer of the stomach first seen at a late stage, W. B. Clarke[2] says: It is the peritonitis which must be treated rather than the ulcer, which has probably been closed by

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[1] Journal American Medical Association, 1905, vol. xlv. p. 620.

[2] British Medical Journal, 1905, vol. ii. p. 775.

adhesions. Any attempt to find it and stitch it up at this stage will probably prove more dangerous than letting it alone. If there are many adhesions and the patient's condition is bad, as it is almost sure to be, the insertion of drainage tubes wherever the collections of septic fluid are to be found, without much attempt at washing out, will be the safer procedure. Cases of peritonitis, whatever the cause, will do better if the cellular tissues of the body are flooded with saline solution which is introduced into the body through the axillæ, under the pectorals and elsewhere. As much as fifteen pints of saline may be introduced into the body in twenty-four hours by this method. A copious flow then occurs from the peritoneum through the drainage tubes, and a marked improvement takes place oftentimes in a few hours, while the patient escapes the severe shock which is always entailed by handling the intestines in the ordinary method of peritoneal flushing.

The after-treatment is of importance. No food should be given by mouth for twenty-four hours or more. If the rectum does not tolerate the usual form of enema, a gravitation enema may be employed. The fluid is placed in a vessel at the side of the bed and kept warm with a night light. By means of a siphon tube, and a soft rubber catheter, it is delivered in the rectum. A stopcock or clip is employed, so that the flow shall be only a few drops per minute, so that it shall not exceed the rate of absorption.

Wallis is also an advocate of large subcutaneous saline infusions, ten to twelve pints being administered in this way, at the rate of a pint in an hour and a half. He cautions against keeping the needle in one place for more than three or four hours, as an abscess is almost certain to develop if it is left in one place longer than that.

DRAINAGE IN DIFFUSE SEPTIC PERITONITIS. V. B. Knott,[1] who considers the subject of drainage in an article on septic peritonitis, says: "As to drainage material I have discarded all forms but two. When a capillary drain is required, the combined tube and gauze drain, consisting of a soft rubber tube at least one inch in diameter, split from end to end and carrying a wick of iodoform gauze which fits loosely its lumen, is employed. When capillary drainage is not demanded, as for instance in the vaginal drains, a similar tube without the wick is used." He leaves in the abdominal cavity a large amount of salt solution, and elevates the head and upper part of the trunk.

LOCAL EFFECTS OF PERITONEAL DRAINAGE. There is probably no part of the body which has been so misunderstood as the peritoneum.

[1] Annals of Surgery, 1905, vol. xlii. p. 75.

Wrong theories have been followed by wrong practices, and these in turn by bad results, which have often been so striking that the practices have been given up before the theories. There is still need of intelligent experimental and clinical study of this extensive subject. Yates[1] gives the results of such a study devoted to one phase of this subject, namely, the reaction of the peritoneum to drainage. Because of its very great practical importance this topic has been the subject of experiment and study from the earliest times. Yates gives an outline of the work of his predecessors after repeating many of their experiments. His conclusions, which are not always in accord with those of previous writers, are in substance as follows:

Drainage of the general peritoneal cavity is physically and physiologically impossible. If attempted, there is always a flow from the potential cavity (in the vicinity of the drain) into the general cavity, no matter what form of drain is employed.

The discharge from the drain and the excess of intraperitoneal fluid is a serous exudate, the result of mechanical irritation of the peritoneum contiguous to the drain. This exudate diminishes rapidly with the formation of encapsulating adhesions between the surfaces, whence the serum originates.

These adhesions, under approximately normal conditions, quickly form about any foreign body (in less than six hours in dogs). Their extent and density depend on the degree and the duration of the irritation of the foreign body. They are primarily fibrinous, but soon become organized (in three days in dogs).

If the irritation persists, the adhesions become progressively more mature fibrous tissue. If the irritation ceases, the adhesions may disappear if the involved surfaces are able to pull themselves loose or can be pulled apart.

Smooth drains are as rapidly encapsulated as rough ones, but they produce a less severe reaction, and hence are preferable. They are also more easily removed. All drains should be gradually and finally removed as soon as possible.

Irrigation through drains is futile to prevent adhesions, and is dangerous.

After a drain is inserted, all intra-abdominal movements should be reduced to a minimum. As soon as it is removed, intra-abdominal activity should be stimulated to aid in the disappearance of adhesions.

Postural methods, unless designed to facilitate encapsulation, are both futile and harmful as far as drainage is concerned. This statement is opposed to claims made by Fowler and Kuster, as reported in

[1] Surgery, Gynecology, and Obstetrics, 1905, vol. i. p. 473.

PROGRESSIVE MEDICINE, June, 1905, p. 123. The former advocated a half sitting position, and the latter a prone position on the face, or nearly so, in order to bring the wound to the lowest point of the abdominal cavity. The question is one better fitted to be solved by experiments upon animals than by clinical observation upon man.

A drain in the presence of infection is deleterious to peritoneal resistance, and should be introduced only to exclude more malign influences.

Peritoneal drainage must, therefore, be local, and is justified as a means to the accomplishment of one of three ends: to control hemorrhage; to render an area extraperitoneal; or to make of the drained area a safe path of least resistance leading outside of the body.

The drainage material should be capable of approximation to the area to be excluded from the general peritoneal cavity, and should so cover it that no abnormal surface but the foreign body appears in the peritoneal cavity. It must extend to the parietes and out through the operative incision, or one especially made for the purpose. In so doing it should come in contact with the least possible number of serous surfaces, and with those least likely to be functionally affected; that is, the omentum and parietal peritoneum only, whenever this is practicable. A Mikulicz tampon best fulfils these conditions in many cases. The centre of it should be withdrawn in twenty-four hours, and the sheath as rapidly thereafter as conditions permit. In other cases a roll of gauze wrapped in rubber tissue (cigarette drain) is recommended. Yates advocates the enveloping of the gauze drain with the tissue after the insertion of the drain. His reason for this he does not make clear. It is much easier to wrap the gauze with the tissue before its insertion.

A word of caution in regard to the use of rubber tissue may not be misplaced. This tissue has a grain, which is sometimes quite distinct. It should be tested before used, and if it splits easily the fibre should run longitudinally, so that a portion of it may not break off and remain in the wound. A rubber finger-cot with the tip cut off makes a better casing for the gauze drain.

THE PREVENTION OF GAUZE DRAINS FROM BECOMING FIXED IN GRANULATIONS. The involvement of a gauze drain in rapidly growing granulations is one of the less important but annoying complications of wounds, especially those of the abdomen. Lauenstein[1] has found a way to avoid this by saturating the gauze with liquid paraffin. This does not interfere with its value as a drainage material, and tends to prevent retention of secretion in the wound, besides absolutely preventing adhesions between the gauze and new granulations.

[1] Verhand. der. deutsch. Gesell. f. Chir., 1905, p. 87.

VAGINAL DRAINAGE BY AN EASY METHOD. W. D. Haggard[1] advocates vaginal drainage instead of abdominal in operations upon women in which the pelvis requires to be drained. He has devised a method of doing this, which seems to overcome the various objections to vaginal drainage as usually carried out. The steps in this procedure are these: When the intra-abdominal work is complete, a strip of gauze is arranged in plaits in the posterior cul-de-sac, and covered by the sigmoid flexure on the left and the omentum on the right. The abdominal wound is then closed and the dressings applied. The patient is then put in the lithotomy position, and the vagina cleansed thoroughly as for any operative procedure. The bunch of gauze can be easily felt behind the cervix. The cervix is drawn down with forceps, and the posterior fornix opened with one cut of the scissors. The gauze is seized and drawn down and tied to the gauze packing, which is placed in the vagina, so that there may be no risk of its being left in the pelvis.

POSTOPERATIVE TREATMENT OF PERITONITIS. W. Noetzel[2] says it is inhuman to let a patient who has been operated on for peritonitis suffer from thirst. Even if drink excites vomiting, this rarely does any harm, and in many cases the act of vomiting stops the thirst. This is especially true in the cases which progress to a favorable termination. In unfavorable cases one certainly has no right by withholding drink to add to the torture of a patient who will die in a little time anyway. Any unnecessary moving of a patient from one bed to another is to be avoided. This has doubtless produced fatal embolism in certain cases.

TUBERCULOUS PERITONITIS. W. J. Mayo[3] says that it is reasonable to suppose that tuberculous peritonitis has its origin in a local focus in every case. His experience has shown that peritoneal reinfection may be prevented if this focus can be removed. Whether the patient will regain and maintain general well-being must depend to a large extent on whether the local focus thus removed is primary or secondary; and if the latter whether the primary disease can be cured. In a few months previous to this report, Mayo and his brother operated on sixteen cases of tuberculous peritonitis. Eleven of the patients were women. In nine of them the focus was in a Fallopian tube, in one in the appendix, and in one the origin of the disease could not be found. During the same period they saw five cases of tuberculous peritonitis in men. The focus was in the appendix and cæcum in three of these cases and could not be found in the other two.

Relapse can unquestionably be prevented by a radical operation. Thus they performed twenty-six radical tubal operations with two re-

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[1] Journal of the American Medical Association, 1905, vol. xliv. p. 1681.
[2] Beit. f. klin. Chir., 1905, vol. xlvi. p. 515.
[3] Journal of the American Medical Association, 1905, vol. xliv. p. 1157.

coveries. Seven of these patients had been previously operated upon by simple laparotomy from one to four times. Thus far a second operation has not been necessary in a single one of these patients. There has been usually a continuance of the peritoneal effusion, but reinfection has not occurred. The outcome when the local focus has been in the appendix has been favorable but not so good as in the tubal cases.

Their method of operation is as follows: If the patient is a woman the fluid is evacuated, and the patient is then placed in the Trendelenburg position, and the general abdominal cavity is packed off in the usual manner. The pelvic organs, appendix, and cæcum are examined. If the Fallopian tubes, appendix, and cæcum are diseased they are removed. The stumps and walls of tuberculous abscess cavities are dried and rubbed with a little sterile gauze and the abdomen is closed without drainage. Drainage sometimes leads to secondary mixed infection with resulting fistulæ, which have a great tendency to become fecal.

If the patient is a man the incision is placed to the right of the median line, over the appendix. The fluid is evacuated, the appendix and cæcum are examined, and if the conditions warrant a radical operation it is performed. If there are masses of fibrous tissue about the cæcum it is removed and the ends of the ileum and colon are closed by suture and a lateral ileocolostomy is performed. In some cases greatly enlarged tuberculous lymph glands exist in the mesentery. As many as possible of these should be removed.

H. O. Marcy[1] looks upon the possibility of tuberculous peritonitis in women as an added reason for the repair of defects in and the removal of diseased portions of the pelvic organs, since the tubercle bacillus usually finds its entrance to the abdominal cavity by this route. The advantages to be gained by operation in the ascitic form of tuberculous peritonitis are: 1. Removal of the fluid. 2. The stimulating effect of exposure of the peritoneal surfaces to the air. 3. The mechanical irritation of sponging. 4. The chemical effect of solutions of mercury, iodoform, etc. All of these measures greatly increase the number of leukocytes, and it is very probable that the destruction of the bacilli and the resulting cure are brought about in this way.

There are reports of more than 1500 cases treated by laparotomy. The percentage of cures in the ascitic form of the disease can be conservatively given as 40 to 50 per cent.

Tuberculosis of Mesenteric Glands. E. M. Corner[2] says that there is a stage in the tuberculous degeneration of glands of the mesentery at which surgical removal may effect a cure. Tuberculous mesen-

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[1] Annals of Surgery, 1905, vol. xlii. p. 775.
[2] Lancet, 1905, vol. ii. p. 1825.

teric glands are common in children, and are found according to different pathologists in from one-half to three-fourths of tuberculous subjects. One writer states that they are the second most frequent source of general tuberculous infection of the body. Branson[1] says that hard, movable tumors in the belly of a child which are not fecal are caseous mesenteric glands. Corner has studied his subject clinically rather than pathologically. Tuberculosis of mesenteric glands, he says, is found most frequently in adults affecting the lymphatic glands which drain the appendix or the ileocecal region. There are three reasons for this: the delay in the passage of food material, the presence of an innumerable number of micro-organisms, and the frequent occurrence of inflammation. It is a notable fact that these glands rarely suppurate, probably because they become so inured to the product of bacterial action. Corner reports one case of this class. A man aged forty-one complained of pain in various parts of his back and abdomen. As nothing abnormal could be found on examination his symptoms were considered "functional." A skiagraph showed a shadow opposite the third lumbar vertebra which might have been due to a renal calculus. Later as the pains became more severe and better localized the abdomen was opened through the right rectus. The atrophied appendix was removed, as was also a caseous gland from the mesentery. It was as large as a walnut, and from its situation it must have caused the shadow in the skiagraph. The patient fully recovered. Corner also reports removal of tuberculous mesenteric glands from three children, aged six, twelve, and twelve years, respectively. In each there was a movable tumor to be felt. In one case it was in the right lower quadrant, and in the other two the mass was under the upper part of the right rectus muscle. In each case the mass was exposed, and the mesentery was incised over the gland on one or both sides and the glands were enucleated. Abscesses were curetted. The wounds in the mesentery and abdominal wall were closed without drainage. Two of these children made a prompt and complete recovery. In the third case the abdominal condition was satisfactory but the boy died in a few weeks of general miliary tuberculosis, the initial symptoms of which were present before operation.

The relation between tuberculosis peritonitis and tuberculous glands is an important one. Tuberculous glands are always present in tuberculous peritonitis. They are, however, small and scattered. Tuberculous glands of the type removed by Corner may exist without peritonitis. He considers them due to tuberculous enteritis—not peritonitis. Moreover, the tumors sometimes felt in tuberculous peritonitis and

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[1] Transactions of the Royal Medical and Chirurgical Society, 1905.

which are due to matting together of intestinal coils, omentum, etc., are usually *movable*. This is an important point to keep in mind, so that one may avoid operating unadvisedly in tuberculous peritonitis. If a caseous focus of this disease is drained, a fistula results which persists till death.

Hydatid Cysts of the Abdomen. Mabit,[1] of Buenos Ayres, recommends a new treatment for hydatid cysts of the abdomen, which he has employed with success in eighteen cases, viz., eight of the right lobe of the liver; three of the left lobe; two of the spleen; three of the omentum, and two of the mesentery. The method is only applicable in those cases in which at least one-third of the cyst is free in the abdomen, or rises above the solid organ in which it is situated, to that extent. The cyst is first exposed, punctured, and its contents evacuated. It is then drawn to the abdominal wound and incised freely. Its lining membrane and any daughter cysts are peeled out and the inner wall of the resulting cavity is carefully inspected and dried. The portion of cyst which is free is then excised, so that a shallow cavity remains, which cannot collapse and is subjected to the influences of the peritoneal fluid. The abdominal wall is then closed entirely.

The objections that have been made to this method of treatment have been shown by Mabit's experience to be groundless. He has never experienced serous transudation from the raw surface, nor a hydatid dissemination throughout the peritoneal cavity. Hemorrhage and a flow of bile from the raw surface are secondary to suppuration only. He has had suppuration in only one case, and in that case the cyst was so deeply embedded in the liver that the cavity was practically a closed one, and not exposed to peritoneal fluids. Hence he recommends his method in those cases only when one-third or more of the cyst lies free. The results of treatment were excellent, all of the eighteen patients recovering from operation. One required secondary drainage, as above stated. Nine were lost sight of. The other nine were free from any recurrence at various periods up to five years after operation.

THE STOMACH.

Gastric Ulcer. EARLY DIAGNOSIS. H. D. Niles[2] says that an earlier diagnosis of gastric ulcer may be arrived at by attention to the following points: 1. The frequency of ulcer as compared with other gastric lesions. 2. The fact that most patients who are operated on for this trouble are either between the ages of thirty-eight and forty-eight, or

[1] Rev. de Chir., 1905, vol. xxxi. p. 587.
[2] Journal of the American Medical Association, 1905, vol. xlv. p. 1217.

else between eighteen and twenty-eight. Niles' patients in the earlier period of life usually led inactive lives; those in the later period, on the contrary, engaged in rather violent exercise. 3. Gastritis, indigestion, and gastralgia are the common results, and hyperacidity is the common cause of gastric ulcer. 4. Chronicity is important. If the stomach ailment is of long duration, and occurs or recurs without apparent cause, it is probably due to a real pathology rather than to a transient functional disturbance, and the causative factor is likely to be ulcer. 5. Any inflammatory lesion which is confined to the mucosa cannot be recognized by palpitation and may yield to medical treatment; but an ulcer that includes the peritoneal coat can be felt during operation, and is always a surgical lesion. 6. An exploratory incision is the crucial test which should always be employed when in doubt, with a preponderance of evidence favoring ulcer. To wait for the appearance of obstructive symptoms, perforation, hemorrhage, tumor, or involvement of nearby structures to confirm a strong suspicion of ulcer would mean to contend with a resultant pathology in every instance, and is nearly equivalent to waiting for abscess formation before operating for appendicitis.

PAIN IN GASTRIC ULCER. Moullin[1] says that the pain in gastric ulcer is usually attributed to the contact of the food with the walls of the stomach; the walls of the stomach, however, are wholly insensitive to such stimuli. The pain is due to dragging upon the nerves in the parietal peritoneum made infinitely more sensitive when there is an ulcer, because absorption from its surface causes some degree of inflammation in the neighborhood. The contraction of the stomach pulls upon these nerves in the parietal layer. The way to stop the pain is to stop the contractions. This can be done by a gastroenterostomy, either dividing freely the great band of muscular fibres which surrounds the prepyloric portion, or else opening up the cardiac portion so widely that the contents of the stomach pass into the jejunum before the prepyloric portion has a chance to contract. Moullin is a strong advocate of gastroenterostomy in every case of chronic ulcer, in which vomiting or pain interfere with the enjoyment of life. He has no preference for either the anterior or posterior operation, as he always makes in addition an enteroanastomosis.

GASTRIC ULCER WITH FATAL HEMORRHAGE IN AN INFANT. A remarkable case of death in a well-developed infant forty-five hours after birth is recorded by Bisset.[2] Death occurred from hemorrhage due to the erosion of one of the branches of the superior coronary arteries of the stomach. Birth was easy and normal, the child nursed properly,

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[1] British Medical Journal, 1905, vol. ii. p. 773.
[2] Lancet, 1905, ii. p. 78.

did not vomit, and presented no abnormal symptom until blood began to pass by the rectum thirty-nine hours after birth. Operation was considered, but not carried out on account of the uncertainty of the diagnosis and the blanched condition of the child. At autopsy the intestine was found filled with blood, and in the stomach there was a mixture of blood, milk, and mucus. The ulcer was on the posterior wall about half an inch from the cardia. It was the typical, acute form with punched-out margins, and so nearly perforating that a very small patch of localized inflammation had already been excited in the peritoneum. There was no other lesion.

TREATMENT OF GASTRIC HEMORRHAGE. In dealing with hemorrhage from the stomach or duodenum two methods may be followed: search for and direct treatment of the ulcer or bleeding vessel, and the indirect method of gastroenterostomy. Moynihan[1] says that an inquiry into the records of cases which have been dealt with by the direct method shows that the bleeding point may be impossible to discover; that although blood can be seen to well up from the stomach wall, no single point can be recognized as its source. The whole surface seems to be weeping blood. Furthermore, when a definite excavation or erosion or ulcer has been recognized, and has been treated directly by ligature, cautery, excision or curettage, and the stomach closed, the hemorrhage has continued as freely as before and has proved fatal. At the postmortem examination in such cases a second ulcer or multiple ulcers may be found, or it may happen that no obvious source of the bleeding is discoverable. Local treatment of the supposed source of the hemorrhage has therefore not always met with adequate success.

On the other hand it was found that gastroenterostomy, though an indirect method of treating the condition, nevertheless stopped the hemorrhage. Moynihan's explanation of this is as follows: In all cases of hæmatemesis or melæna the tendency to spontaneous cessation is known to be remarkable. The cause of its continuation in certain cases he believes to be the distention of the stomach. In most of the patients upon whom he has operated this distention was marked. In one case it was necessary to puncture the stomach before performing gastroenterostomy. The result of the anastomosis is at once apparent in the emptying of the stomach. He looks upon this operation as the safest, surest, and speediest way to check the outpouring of blood. In every instance in which he has employed it the arrest of the hemorrhage has been complete and permanent. There are, however, some cases on record in which the hemorrhage persisted after gastroenterostomy, and proved fatal. In some of these the use of Murphy's button, which fell back into the stomach, was probably the cause of

[1] British Medical Journal, 1905, vol. ii. p. 767.

continued hemorrhage. From these facts Moynihan concludes that the bleeding vessel should be ligated when that is feasible, and that gastroenterostomy should be performed anyway.

Tuffier and Jeanne[1] in an exhaustive article consider all the details of hemorrhage occurring in the course of simple gastric ulcer. Proper medical treatment will cure most of these patients—probably not less than 93 per cent. Tuffier and Jeanne believe that the hope for those who receive no benefit from medical measures, lies in surgery. They claim, moreover, that gastric ulcer with hemorrhage is from the first a surgical disease, since the necessity for operation may arise at any time. The decision to operate is based upon a number of symptoms—a high degree of anæmia as shown by the blood count and percentage of hæmoglobin; a constantly accelerated pulse; repeated hemorrhage; and especially a recurrence of hemorrhage in spite of proper medical treatment. Contraindications for operation are anæmia, so great as to produce syncope, and an incomplete operating equipment.

Proper medical treatment of gastric hemorrhage, according to these writers, consists in absolute rest of the body and stomach. The patient lies on his back with an ice-bag upon his epigastrium. No fluid is to be given by mouth, or at most a few drops of adrenalin solution, 1:1000. Other local coagulants do more harm than good. Chloride of calcium (4 to 8 grams a day) should be given in a warm rectal injection. One per cent. of gelatin in normal saline solution may be injected subcutaneously to the extent of 100 to 150 c.c. (3 to 5 ounces). This may be repeated on the second or third day thereafter. In addition normal saline solution should be injected subcutaneously to the amount of one or two quarts daily. By this means the patient will be enabled to pass several days without drinking any fluid. After four or five days rectal alimentation should be commenced. Mouth feeding should not be undertaken for three or four weeks.

Such in brief is the outline of a thorough medical treatment in these cases. If this fails, one of the various surgical operations should be performed.

The choice of operation is well indicated by the following table:

Ulcer limited to the coats of the stomach.	Easily accessible.	Involving mucous membrane.	Ligature en masse of the mucous membrane; transmucous suture.
		Involving all the gastric coats.	Resection (gastrectomy or pylorectomy) followed by suture in two planes.
	Accessible with difficulty (situated too high, for example).	Mucous.	Cauterization.
		Total.	Ligature at a distance from the ulcer of both extremities of the eroded vessel.

[1] Rev. de chir., 1905, pp. 195 et seq.

Ulcer having passed the walls of the stomach; adherent.	Without pyloric stenosis.	Easily accessible.	Detachment of the edges of the ulcer (with possible freshening of same) and suture. Ligature of eroded vessels in the wound.
		Inaccessible.	Ligature at a distance.
	With pyloric stenosis.		Gastroenterostomy, combined, if possible, with some other procedure to control hemorrhage.
Multiple and disseminated ulcers.			Gastroenterostomy, associated, if necessary, with some means of controlling hemorrhage
Ulcer not found.			Gastroenterostomy.

The steps in operating are as follows:

1. Median incision from the ensiform cartilage to the umbilicus or below.

2. Evacuation of stomach contents by aspiration through a trocar and cannula.

3. Examination of the peritoneal surface of the stomach, including the anterior surface, the curvatures, the orifices, and (after tearing through the gastrocolic omentum) the posterior surface.

4. Incision of the stomach longitudinally in the middle of its anterior surface. The incision should be three or four inches in length and should reach to within two fingers' breadth of the pylorus. The liquid remaining in the stomach is sponged out and the whole mucous surface inspected. Some operators evert the stomach for this purpose.

5. Control of hemorrhage and treatment of the ulceration by one of the methods referred to in the table given above.

Ligation of an artery at a distance requires some further explanation. To control hemorrhage of the lesser curvature it is necessary to ligate the gastric artery, not far from its origin. This is easily found by drawing the lesser curvature forward till the lesser omentum is put on the stretch. Near its tense border lies the vessel possibly concealed by a little fat.

The gastroduodenal and the splenic are less easily ligated in fat persons. The former should be searched for from above the stomach after tearing through the lesser omentum, and with retractors separating and drawing downward the lesser curvature of the stomach and duodenum, as if to expose the head of the pancreas. The artery will be found lying on the pancreas close to the duodenum. It is then easily freed and ligated.

The splenic is more or less masked by the superior border of the pancreas. It can be found by the same technique which is employed to

expose the gastric artery. The origin in the celiac axis is to be noted, and its trunk followed until it disappears behind the pancreas before the ligature is applied. The coronary vein of the stomach lies in front of it and may be torn in the search.

6. The final step in the operation is the suture of the rent in the greater omentum and closure of the abdominal wall with or without drainage.

Results. Rodman's[1] statistics gave a mortality after operation of 37.5 per cent. in thirty-two cases. Tuffier and Jeanne have been able to find twenty-two other cases with eight deaths, leaving the percentage of mortality almost the same, namely, 37 per cent.

PERFORATING GASTRIC ULCER. Moynihan[2] says that there are four points in the treatment of acute perforating ulcer of the stomach, which need discussion. They are:

1. *Excision of the Ulcer.* This he does not believe necessary in most cases. It consumes time, may excite profuse bleeding, and may lead to the soiling of the parts in the vicinity by escape of gastric contents through the enlarged opening in the stomach.

2. *Peritoneal Irrigation and Drainage.* The earlier the patient is seen the less need is there of irrigation and drainage. Other factors which have a bearing upon this decision are the occurrence of vomiting, the size and number of perforations and the extent of pre-existing adhesions, which may have limited the spread of escaped fluid. If irrigation is employed, free drainage should follow it.

3. *Gastroenterostomy.* Whether this is necessary will depend upon the situation of the ulcer, and whether more than one is present. If the ulcer is near the pylorus, and obstruction is present, or is produced by the infolding of the gastric wall in closure of the ulcer, gastroenterostomy will be necessary.

4. *Lavage of the Stomach* should be performed in almost all cases in order to do away promptly with the dirty turbid fluid which has to be mopped away constantly from the opening in the stomach during operation.

PERFORATED GASTRIC ULCER; SUCCESSFUL OPERATION; DEATH FROM HEMORRHAGE. R. E. Sedgwick[3] reports a case of perforation of a gastric ulcer occurring in a stout girl of seventeen years. Operation was performed twelve and one-half hours later. The ulcer was in the anterior wall of the stomach, one-third of the distance from the pylorus to the cardia. Excision and transverse suture were performed. The abdominal cavity was wiped out and the wound sutured. The patient was fed by rectum for a week, then, as her condition was satis-

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[1] PROGRESSIVE MEDICINE, June, 1901, p. 124.
[2] British Medical Journal, 1905, ii. p. 767.
[3] Lancet, 1905, ii. p. 1395.

factory, mouth feeding was begun. The stools were normal. Two days later there was intense epigastric pain for one and one-half hours, and progressing anæmia. All food by mouth was stopped. On the tenth day the stools became tarry, and continued so until death, eleven days after the operation. At autopsy there was found a second gastric ulcer, near the first, which had almost perforated, and an ulcer of the duodenum, which had eroded two small bloodvessels.

This complication raises an interesting question of treatment. Sedgwick suggests that a gastroenterostomy be added to the excision and suture of a perforated gastric ulcer if the patient's condition warrants it. There is no doubt that gastroenterostomy is an efficient treatment for duodenal ulcer, either with or without hemorrhage. Moynihan has performed this operation for duodenal hemorrhage a number of times, and has never failed to control the hemorrhage. It would certainly be an extreme statement to say that gastroenterostomy should be performed as a routine treatment in every case of perforated gastric ulcer, but if at operation other non-perforated ulcers are recognized, it should at least be considered.

SUBACUTE PERFORATION OF GASTRIC ULCER. Moynihan[1] in his address on " Non-malignant Diseases of the Stomach," at the last meeting of the British Medical Association, called attention to a variety of perforating gastric ulcer, which he spoke of as subacute. The ulcer probably gives way almost as quickly as in the acute form, but owing to the small size of the ulcer, or to the emptiness of the stomach, or to the instant plugging of the opening by an omental flap, or to the speedy formation of lymph which forms a cork or flap for a lid for the ulcer, the escape of fluid from the stomach is small in quantity, and the damage done thereby is less considerable. The symptoms at their outset may be as grave as those of acute perforation, but on opening the abdomen the ulcer may be found sealed over and no further escape of fluid is occurring. Free fluid is always present in the abdomen, but it is clear and sterile, and possesses antibacterial properties. It is due to the response made by the peritoneum to the threatened invasion by the harmful contents of the stomach or duodenum. If such an ulcer lie near the pylorus there is no need to separate it from its adhesions, if these are firm. A gastroenterostomy may be performed and the ulcer left untouched.

F. B. Lund[2] gives a history of three cases of gastric ulcer with subacute perforation, the minute opening being closed almost immediately by adherence to the liver (two cases), or the anterior abdominal wall (one case). The symptoms in this class of perforations are similar to

[1] British Medical Journal, 1905, ii. p. 767.
[2] Boston Medical and Surgical Journal, 1905, vol. clii. p. 516.

those of acute perforation, with the important exception that they are less violent, and are not followed by collapse or general peritonitis. The location of the pain and tenderness depends on the location of the ulcer, and varies with it. The treatment should be, if possible, posterior gastroenterostomy, without breaking up protective adhesions.

CHRONIC GASTRIC ULCER. Moynihan[1] believes in an earlier and more complete diagnosis than is generally arrived at. He has found that, as a rule, the existence of an ulcer can be ascertained and its position foretold before operation, with an approximation to certainty. The time of the onset of pain after eating is a sign of the greatest importance, though it has been scoffed at by many physicians. If it comes on within half an hour after taking food the ulcer is almost certainly in the cardiac half of the stomach. In such a case at operation an ulcer may be found near the pylorus and the symptom of early pain is discredited; whereas, a further search would have revealed a second ulcer in the cardiac portion. Postural changes, and the effect they have upon the pain, do not seem to be of diagnostic value. The exact situation of superficial tenderness is, however, a sign of real value. Thus, in the last year or more, Moynihan has carefully noted before operation the location of pain elicited by pressure upon a restricted area. He has found that when an ulcer is in the cardiac portion, or along the lesser curvature, there is tenderness high up in the epigastrium and to the left, or in some patients along the left costal margin. Tenderness to the right of and above the umbilicus is elicited in case the ulcer is in the pyloric portion.

The radiation of pain is also of value. In three cases of ulcer near the lesser curvature or anterior wall, with adhesions to the under surface of the liver, pain radiated upward to or into the right breast. In two cases of ulcer adherent to the diaphragm on the left the pain radiated upward into the left breast. In pyloric or duodenal ulcer with plastic adhesions there may be a sudden exacerbation of pain or laughing, or deep inspiration, or the patient may feel something drag when the body is straightened up. It is highly important the surgeon should make note of these and similar symptoms, as postmortem work cannot increase our diagnostic ability along these lines. In many cases of gastric ulcer the physical signs may be conspicuous by their absence; there may be no dilatation of the stomach, no local tenderness, no gastric stasis, and no obvious peristaltic waves; yet the surgeon is justified in operating if chronic dyspepsia is present, and in almost all of such cases he will find abundant reason when the abdomen has been opened.

[1] British Medical Journal, 1905, vol. ii. p. 767.

A. B. Mitchell[1] contributed to the discussion of this paper the reports of four cases in which he had performed operation for gastric ulcer or its sequelæ, with temporary benefit, but with later recurrence of symptoms, due in three of the cases to failure of the original operation to interfere with the pyloric sphincter. This continuing to act, prevented complete rest, and caused the retention in the stomach of certain irritating substances. In the fourth case a gastroduodenostomy was performed, but the artificial opening was made close to the original ulceration, and being limited in size by the site selected, became obstructed by surrounding adhesions. He therefore concludes that those surgeons are correct in their views who hold that the most efficient surgical procedure for the relief of symptoms dependent on gastric ulcer and its sequelæ is a posterior gastroenterostomy. This operation he performed with complete relief of symptoms in three of the cases mentioned. The fourth patient had not agreed to further operation. Chronic constipation is almost always cured by gastroenterostomy, but just how may be open to question. Two chief elements in the cure are these: 1. That fluids are no longer absorbed in large quantities from the stomach, but find their way freely into the intestines, and act as an intestinal flush. 2. That the digestive process which now takes place in the intestine, instead of in the stomach, acts as an intestinal stimulant and aperient.

CHRONIC ULCER OF THE STOMACH AND FIRST PORTION OF THE DUODENUM. W. J. Mayo[2] writes of the operative work done by himself and C. H. Mayo, namely, 384 operations for gastric ulcer, and its results, and eighty-four operations for duodenal ulcer. They believe that chronic ulcer of the stomach is far more common than clinical diagnosis would indicate. This is always seen to be the case when postmortem records are kept with care, as in many foreign hospitals, and more recently in some American hospitals.

The Mayos believe in gastroenterostomy as a curative method of treatment. They have records of 231 cases, 119 in the male and 112 in the female, occurring in their operative practice in the last three years. The location of the ulcers was as follows: 158 gastric, 60 duodenal, and 14 duodenal and gastric. Clinically these ulcers are best considered as *indurated* and *non-indurated*.

The *indurated* ulcer involves all the coats of the organ, and there are usually evidences of cicatrization in places. The diseased area is a thickened milky-white patch, easily identified from without the gastric or duodenal wall. In the stomach it involves the pyloric portion in the great majority of cases, being frequently saddle-shaped, and riding the lesser curvature, and extending flap-like down the antertor and posterior walls. In such cases the pyloric portion beyond is usually thickened

[1] Loc. cit.   [2] Journal of the American Medical Association, 1905, vol. xlv. p. 1211.

and gives rise to more or less obstruction, even if not actually involved in the ulcerative process. In about 20 per cent. of the cases more than one ulcer was found.

In the duodenum the first two and one-half inches are always involved, well above the entrance of the common duct with its alkaline discharges, and the ulcer extends up to the pylorus or within three-quarters inch of it. In only three instances could more than one duodenal ulcer be shown. Sixty-eight of the seventy-four duodenal ulcers were of the indurated variety, as were 151 of the whole series of 231 gastric and duodenal ulcers. Associated with indurated ulcers are benign pyloric obstructions of inflammatory origin, hour-glass stomachs, adhesions and deformities arising from protected chronic perforations.

The *non-indurated* ulcer has also been termed a medical or clinical one, because as it involves only the mucous coat, it is not easily recognized upon operation. In some cases a little thickening can be discovered (Mikulicz), or a little gluing of the mucus to the muscular coats, preventing the normal slipping of one on the other (Moynihan); but in the typical case prolonged search of the interior of the stomach may be necessary to find the disease process. Many an individual has bled to death from an ulcer so minute that it could only be found with the microscope. Bramwell says that many of these cases heal so perfectly that no evidence can be found at autopsy. In a number of Mayo's cases, patients who for years had suffered from hemorrhages, retention of food, etc., presented stomachs the interiors of which were apparently normal. Some were even opened and searched in vain for an ulcer, and yet these patients were cured by operation.

Lund pointed out that an ulcer can sometimes be located by an enlarged "sentinel" gland in the omentum, tributary to the lesion. This has been verified by Mayo. Such glands are about the size of a lima bean and soft. The hard glands in cancer are usually situated in the lesser omentum, as is well known. In cholecystitis there are enlarged glands in the greater omentum, but also along the common duct.

Treatment by Operation. The Mayos warn against the too hasty operation upon the stomachs of neurasthenics. Gastric atony also is not a sufficient indication for operation unless there is marked and persistent delay of the food in the stomach. At present they do not advise operation in cases of acute ulcer unless perforation hemorrhage or grave obstruction compels its speedy performance. Nor do they advise operation in chronic ulcer or its associated diseases until careful and prolonged medical treatment has failed to permanently cure. Operation upon neurotic individuals with prolapse of the stomach is strongly advised against. Operation is advised in all cases of stagnation and retention of food, depending on mechanical causes, such as pyloric ob-

struction and cases of exhausting hemorrhage. They also advise and practice operation in that considerable group of chronic cases with acute exacerbation in which frequent relapses with their attendant disabilities prevent the patients from the enjoyment of good health.

What percentage of gastric and duodenal ulcers may be expected to be cured by medical means? Five hundred cases treated medically in the London Hospital in the five years from 1897 to 1902 gave a per-

FIG. 21
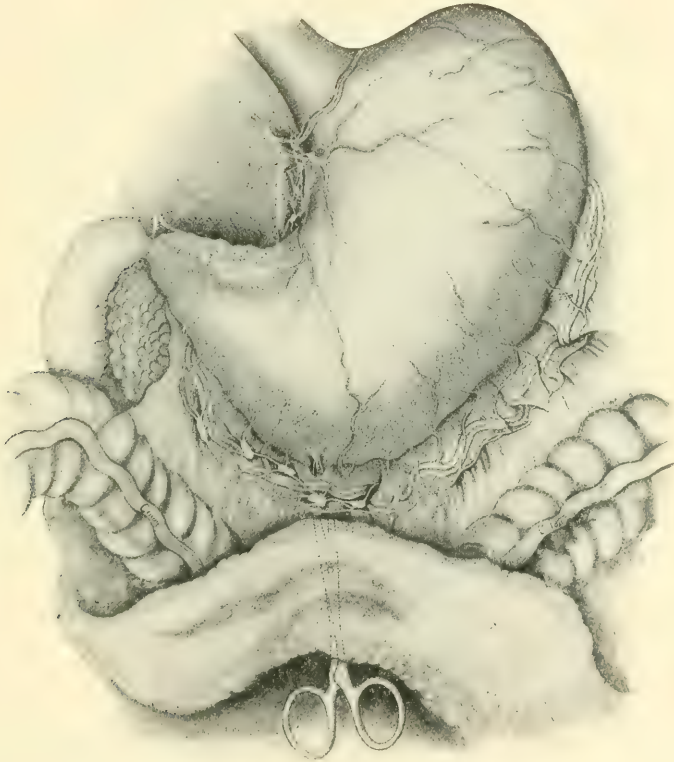
Showing forceps passed through from behind and grasping anterior gastric wall near the greater curvature at the lowest point. Saddle ulcer of lesser curvature near pylorus. (Mayo.)

centage of eighteen for the death rate, and forty-two per cent. were not cured at the time of discharge. As 211 of the 500 had been cured one or more times of previous attacks, who can predict the future history of the 40 per cent. discharged as cured?

What results can surgery show in this field? It has demonstrated the frequency of ulcer of the stomach and duodenum. Second, it has demon-

strated the operative curability of ulcer and associated disorders.   In
doing even this much it has been open to sound criticism; first, on the
occasional selection of an unfortunate case for operation, and second, on
the occasional unsatisfactory results of operation, both as to mortality
and as to permanence of cure.   It is the surgeon's duty to overcome
this prejudice by furnishing better results.

FIG. 22
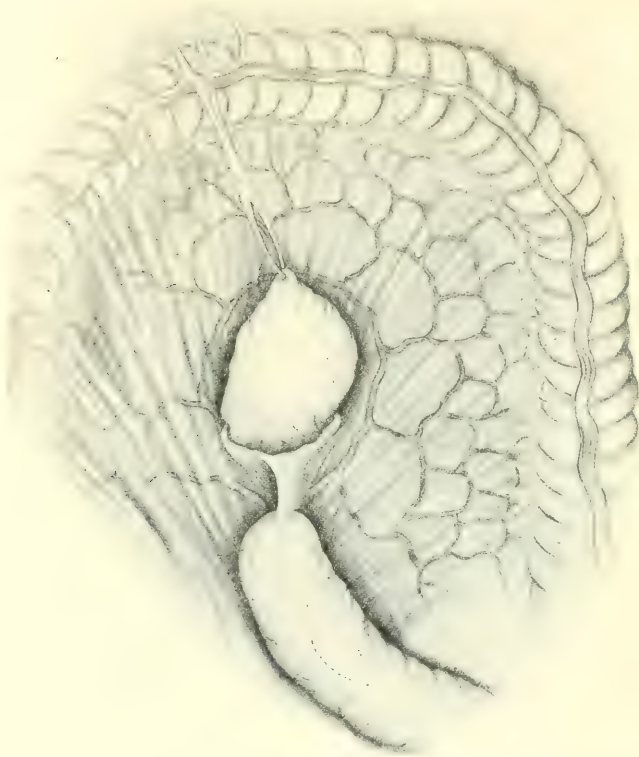
Posterior wall of the stomach drawn through opening torn in transverse mesocolon.
Forceps still marking low point.   Dotted lines on stomach and jejunum show situation
of proposed anastomosis.   (Mayo.)

Surgery is essentially mechanical and must benefit the patient in a
mechanical way to a large extent.

Most surgical questions connected with chronic ulcer arise from
interference with good stomach drainage, either by actual obstruction
or by muscular spasm, so that the food and secretions are subjected to
delay in that part of the stomach lying to the left of the pyloric mus-
cular portion (the pyloric portion is that part covered by the lesser
curvature).   The method of relief which has the largest field of useful-

ness consists in gastrojejunostomy made on a line perpendicular with
the cardiac orifice of the stomach (Fig. 21). This will usually be found
to be the most dependent portion. The opening must be placed on
the posterior wall, at the very bottom of the gastric cavity, and should
extend anteriorly one-fourth of an inch, so that the jejunum is mor-
tised on to the stomach (Fig. 21). The line of the gastric opening

Fig. 23
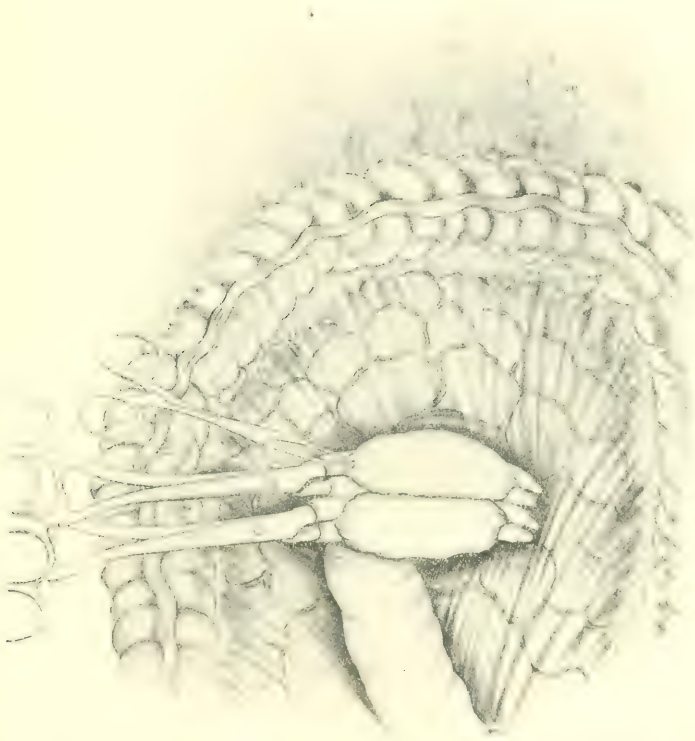
Stomach and jejunum drawn into clamps for suturing. Small forceps still marking
low point of stomach. (Mayo.)

should be that of Moynihan, oblique from above down and left to right
(Fig. 22). The jejunum should be anastomosed within three inches of
its origin, so that there shall be no loop (Fig. 23). After an experience
of somewhat over 500 gastroenterostomies, including gastroduodenos-
tomies and pyloroplasties, the Mayos have come to Peterson's conclu-
sion that the loop has been responsible for the greater part of the evils
arising after gastrojejunostomy, such as biliary regurgitant vomiting
(vicious circle). The intestine should be secured so high that there
can be little loss of nutrient absorbents. The straight drop of the

bowel gives protection against secondary jejunal ulcer by constant presence of the alkaline biliary and pancreatic secretions, and also adds to the security against future complications.

There is no doubt that contraction of the opening is less liable to take place if there is no loop to make traction. As to mortality, they have had less than 3 per cent. mortality in their last 150 suture operations, and in the last eighty-one cases of benign disease there has been but one death. These results are no better than those of Ochsner, Murphy, Munro, Deaver and others in this country, and Robson, Moynihan, Mikulicz, Kocher, Hartmann and others abroad.

The operation here advocated has given them better results than any other which they have tried, but they have had two cases of chronic bile regurgitation occur, evidently due to faulty technique. In both patients there has been great relief of the original symptoms, and in neither has the complication as yet been of sufficient moment to require a second operation.

While gastrojejunostomy has the largest field of usefulness, we must not look upon it as a cure-all. It is purely a drainage operation. If the stomach is not dilated and the pylorus be not obstructed the food will continue to pass out the normal outlet and the patient will not be benefited. For this reason indurated ulcers with definite mechanical lesions give far better results than non-indurated ulcers in which obstructions are not found, and it is this latter group which gives a considerable percentage of secondary operations and complications.

Hartmann's[1] operation resembles that of Mayo and Moynihan in that it is posterior. No clamps are used, however, as a slight Trendelenburg position prevents the escape of fluid from the stomach. The anastomosis is made only 8 or 9 cm. away from the duodenojejunal flexure. Two rows of silk sutures are used: the outer one serous and muscular, the inner one including all the planes of tissue. Hartmann employs an ordinary sewing needle, and knots the suture in several places, especially at the ends and whenever the wall tends to bleed. He has never had a leakage. The bowel is fixed obliquely downward and to the right, and the opening is made in the inferior right part of the apposed portions. Most of his fatalities have been due to pulmonary complications, and now he is very careful to attend to the antisepsis of the mouth several days previous to operation. After operation, if the tongue is dry and the temperature exceeds 37.5° C. (99.5° F.), he washes the stomach out with boiled water. He experienced circulus viciosus only once. In that case the stomach was insufficiently fixed to the mesocolon, so that it retracted and dragged the loop of intestine

[1] British Medical Journal, 1905, vol. ii. p. 772.

upward. The surgeon should be on his guard against operation in nervous dyspepsia, or in atonic dilatation with gastroptosis.

Ries[1] advocates resection of the ulcerated gastric area if the patient's condition warrants it, for the reasons that after gastroenterostomy some ulcers perforate, others do not heal, and some are either carcinomatous at the time of operation, or become so later. These reasons are sound, but they state only one side of the case. The risk of resection is considerably greater than that of anastomosis, and patients have died after resection from hemorrhage or leakage or other causes who probably would have survived anastomosis at the hands of the same operators. Ries recognizes this, for he says:

" Here, as in other fields of surgical work, it is impossible to lay down hard-and-fast rules. It is necessary to consider every phase of the individual case. After careful investigation of the patient's general condition, the decision as to the exact procedure to be followed will always have to be made in the course of the operation itself. At that time the patient's amount of strength sets the limit for what *may* be done, and the pathological changes dictate how much *must* be done."

In some cases he advocates anastomosis as a preliminary measure, to be followed by resection when the patient has gained strength by some weeks of feeding.

Taking the views that he does, it is not surprising that Ries is somewhat indifferent to a preliminary diagnosis of carcinoma. He rejects utterly analysis of the gastric contents as entailing some risk to the patient and giving unreliable results. Even the presence of a tumor does not make the diagnosis certain, as shown by two cases in his series. In one of these, 600 sections were made of the base of the excised ulcer, but no carcinoma was found. In the other case a gastroenterostomy was performed, and the tumor which had been palpable for at least two years, gradually disappeared. These two patients both recovered complete health and remained well up to the time of report some years later, so that the clinical evidence also supported the diagnosis of non-malignant ulcer with palpable tumor.

Duodenal Ulcer by One of its Victims is the title of a paper by F. K. Cooke,[2] who advances a new theory to explain the occurrence of gastric and duodenal ulcers. It is a well-established fact, he says, that intestinal parasites are protected from the digestive ferments in which they live by antidigestive ferments found in their skin. It has also been proved that the walls of the alimentary canal are able to protect themselves from self-digestion by certain antibodies contained in their epithelial cells. Any disproportion between the composition of the

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[1] Surgery, Gynecology, and Obstetrics, 1905, vol. i. p. 498.
[2] Medical News, 1905, vol. lxxxvii. p. 884.

blood and gastric juice may give rise to an ulcer either in the stomach or duodenum by diminishing the antibodies in the epithelial cells. Such disproportion may be due to anomalies in the composition of the blood as seen in anæmia, chlorosis, etc., or to an increase in the hydrochloric acid of the gastric juice. This explains the greater frequency of gastric ulcers in women, and of duodenal ulcers in men. Cooke also believes that it is only a question of time until the work now being done on immunity will take all these cases away from the surgeon's knife. Until that happy day comes, however, he recognizes the importance of early diagnosis and prompt resort to the surgeon if medicines do not give results. What he has to say about pain and tenderness is naturally reliable. The pain in his case was sometimes merely epigastric discomfort, and again it was burning in character and radiating toward the right shoulder. When it was severe it was almost always a little to the right of the median line, about in the parasternal line, and 2 cm. (1 inch) below the gall-bladder. He agrees with what Moynihan says about the time of the onset of pain, being a valuable indication of the seat of ulceration. Tenderness when present coincides in location with the pain. Vomiting is of a reflex character and occurs when the pain is very severe. The pain may be relieved by taking food –a glass of milk, or better a boiled egg. This is either because the reflex spasm of the pylorus prevents the escape of stomach contents, or because the food dilutes the excess of acid gastric juice.

C. G. Cumston[1] says that duodenal perforation is likely to be mistaken for appendical, because the pain first noticed is on the right of the median line, in the hypochondrium, and the peritonitis is apt to be most pronounced in the ileocecal region. He advocates an exploratory incision below the umbilicus in cases in which it is impossible to decide between these two lesions. If the peritoneal fluid is acid, and has no fecal odor, the perforation is probably in the stomach or duodenum.

SYMPTOMS OF DUODENAL ULCER. C. L. Scudder,[2] in a report of the successful suture of one case each of perforated gastric ulcer and perforated duodenal ulcer, compares the symptoms of ulcer in the two situations. Duodenal ulcer gives epigastric pain, relieved for a couple of hours by food. It is also relieved by vomiting of very acid material and by belching of gas. The pain is more intense than in gastric ulcer, and simulates gallstone colic. It has not, however, so sudden an onset, and does not radiate so readily. Gallstone colic also occurs independent of food, and the vomit is rarely acid. Graham says:

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[1] Medical News, 1905, vol. lxxxvii. p. 1014.
[2] Boston Medical and Surgical Journal, 1905, vol. clii. p. 540.

" When the duodenum is involved the gas, acidity, and vomiting are as a rule more intense than if only gastric pyloric ulcer is present." Blood may be vomited, but is usually found only in the stools. Scudder's patients recovered from suture of the ulcer, and as both gave a history of chronic ulcer, they submitted five months later to the operation of posterior gastroenterostomy, by which they were greatly relieved of their symptoms.

PERFORATING DUODENAL ULCER. OPERATION AT SEA. A record of successful operation under the most unfavorable circumstances is communicated by H. W. Bayly.[1] The patient was a man aged twenty-four, with a history of " gastric ulcer." When two days out from Barbadoes he was badly overcome by sea-sickness. On the next day he had sharp pain three inches to the right of the umbilicus. Two hours later perforation of a duodenal ulcer was diagnosed, and operation was performed six hours after onset of the pain. The facilities for operation were extremely limited, but a perforated ulcer of the anterior surface of the duodenum, just below the pylorus, was exposed and closed by a purse-string suture and Lembert sutures. A second incision was made suprapubically for irrigation with saline. Both openings were drained. During convalescence transfusion was more than once resorted to, to supply the fluid lost by vomiting, due in part, at least, to the rough weather. The patient ultimately made a complete recovery.

GASTROENTEROSTOMY FOR DUODENAL ULCER. F. Eve[2] has performed this operation twice for relief of duodenal ulcer. Both patients were males, suffering pain, two or three hours after eating, with melæna but no hæmatemesis. There was no vomiting in one case and no tenderness in either. The stomach was explored in both instances by an incision in its posterior wall long enough to admit the hand. There was no abnormality of the stomach or pylorus. The forefinger passed through the pylorus readily detected an ulcer of the duodenum, in each case about an inch and a half beyond the pylorus. The opening in the stomach was partially closed and the remaining portion utilized for gastrojejunostomy. Both patients were greatly benefited by the operation.

Gastroduodenostomy. S. White[3] has performed this operation five times with complete success. It was recommended in 1902 by Finney. In each of White's cases there had been hæmatemesis and other typical symptoms of gastric ulcer which had resisted prolonged medical treatment. In three cases there was narrowing of the pyloric outlet, with dilatation of the stomach. In all of the five cases the pylorus could be

[1] Lancet, 1905, ii. p. 351.
[2] British Medical Journal, 1905, ii. p. 117.
[3] Ibid., p. 860.

drawn outside of the abdomen, an important point in the easy performance of gastroduodenostomy.

Brewer[1] prefers Finney's gastroduodenostomy to gastrojejunostomy in cases of cicatricial stenosis of the pylorus, when the tissues are not too infiltrated. The mortality of both of these operations in capable hands should not be over 4 per cent., and as a permanent cure may be expected in a large majority of cases, it is difficult for him to appreciate why the rank and file of the profession do not give their unqualified approval to this method of treatment.

Gastric Tetany Relieved by Gastroenterostomy. Mackay and Macdonald[2] report that a woman aged fifty-two, suffering from dilated stomach and retention of food, was temporarily relieved by gastric lavage, which she practised for four months. She then had a typical attack of gastric tetany. Lavage was performed, but it brought on another convulsion. Pain and distention continued and laparotomy was performed on the following morning. The dilated stomach was congested and contracting freely against the pylorus. The latter was very hard, but free from adhesions. A posterior gastrojejunostomy was performed. Convalescence was satisfactory. The pulse fell from 100 to 80 by evening; the trace of albumin disappeared from the urine in ten days, and there was only a trace of the rigidity of the fingers remaining in three weeks. While the patient appeared conscious between the tetanic seizures, previous to operation, the consciousness was imperfect, as she had no recollection of events occurring between the first seizure and the operation.

Sequels to Gastric Operations. ACUTE DILATATION OF THE STOMACH AFTER OPERATION. This subject was recently discussed by the Société de Chirurgie of Paris,[3] several of those present mentioning cases in illustration. Legueu operated upon a woman for renal tuberculosis. Four days later the stomach was observed to be greatly distended. A tube was introduced and two quarts of dark fluid were withdrawn. The evening of that day the tube was again passed and three pints of fluid were withdrawn. This was repeated on the next day and on the next. The patient died without fever on the twelfth day. He looked upon this gastric dilatation as similar to that which occurs in the dog after division of the pneumogastric nerves.

Reynier emphasized the importance of an early recognition of gastric dilatation. With the first symptom, one should wash out the stomach. He has seen " véritables résurrections" follow this treatment, so that he employs it systematically after operation whenever a patient vomits, or

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[1] Medical News, 1905, vol. lxxxvii. p. 49.

[2] Lancet, 1905, ii. p. 1470.

[3] La Semaine Medicale, 1905, pp. 571, 595.

even hiccoughs, if at the same time the face is altered and the pulse accelerated. With regard to the etiology he said that some cases seem to be due to infection, while others are not. They may perhaps be attributed to irritation of the solar plexus. An excess of hydrochloric acid occurring in a patient of nervous temperament probably favors the gastric dilatation, judging from some chemical analyses.

Rouvier believed such cases are really forms of septicæmia, a view also shared by Walther.

Legueu could not agree with them, as the operative wound had entirely healed per primam when the patient succumbed with the gastric trouble.

Quénu supported Legueu's belief and cited a case in which gastric dilatation came on eight days after an operation for hernia, the wound having united meanwhile per primam.

Hartmann advocated washing out the stomach and then administering eight ounces of milk.

Tuffier also believed in paralysis of the stomach leading to acute dilatation without any infection. In other cases there has doubtless been a previous chronic dilatation of the stomach, which afforded a reservoir for the great quantities of fluid vomited after operation.

Terrier maintained that in all cases in which stomach symptoms arise after operation upon the stomach itself there is some infection present. In a long experience in gastric surgery he has found postoperative lavage of the greatest importance.

UNUSUAL SEQUEL TO GASTROENTEROSTOMY. J. Kaufmann[1] narrates a series of misfortunes which one of his patients experienced. In 1901 he referred this patient to a surgeon, who performed posterior gastro-jejunostomy and also anastomosis between the ascending and descending loops of intestine, using silk sutures for both. At the time the man was suffering from well-marked pyloric stenosis and hæmatemesis. His condition was much improved for three months, and he gained twenty-seven pounds. Then his gastric symptoms gradually returned, and became worse. In about a year symptoms of stricture of the transverse colon were added. In two years vomiting of colonic fecal matter was added. This was only temporarily relieved by lavage. Thorough antisyphilitic treatment also failed to improve his abdominal condition, though it was followed by the disappearance of certain cerebral symptoms. Finally somewhat more than four years after his first operation the abdomen was a second time opened. There was a large fistula between colon and stomach, and another between colon and jejunum. Both were divided and sutured. This caused such a

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[1] Medical News, 1905, vol. lxxxvii. p. 53.

narrowing of the colon that the sigmoid and ascending colon were anastomosed. At autopsy no trace was found of an anastomosis between stomach and jejunum, and the opening between the ascending and descending loops of jejunum was still patent, but very small. A number of cases have been reported in which such anastomotic openings have narrowed, but only a very few, possibly only one, in which the loop of bowel had entirely separated from the stomach, so that no trace of anastomosis could be found. None of the organs nor the brain showed lesions of syphilis. Kaufmann ascribes the abnormal openings to peptic ulcers of the jejunum.

INTESTINAL OBSTRUCTION FOLLOWING GASTROENTEROSTOMY. Lund[1] mentions the occurrence of intestinal obstruction seven weeks after a posterior gastroenterostomy. The loop used was a long one (fourteen inches) and enteroenterostomy was performed. The obstruction was due to a twisting of this loop. Lund thinks this was the result of violent vomiting on account of too much ether. The loop was untwisted and sutured to the mesocolon. This was followed by relief of the vomiting.

LATE RESULTS AFTER GASTROENTEROSTOMY FOR CHRONIC ULCER AND DILATATION. T. G. Atkins[2] says that some skeptics doubt the efficacy of gastroenterostomy to confer lasting benefit; that in a certain number of cases the old symptoms return, and that new ones arise, the direct result of operation, such as peptic ulcer of the duodenum, or pain due to fresh adhesions; and that the new opening is likely to close in time. In order to dispel these doubts, he made inquiries of sixteen patients who had been operated on more than a year and found that fifteen were free from all pain, fifteen had never vomited, none of the sixteen had vomited blood, and all were able to resume their former occupation, and that eleven of them had gained in weight. The operation which Atkins used to perform was gastrojejunostomy with jejunojejunostomy; and this was the operation performed in most of these cases. More recently he has been performing gastrojejunostomy close to the duodenum and omitting the intestinal anastomosis.

LATE RESULTS AFTER PYLOROPLASTY. Morison[3] has late reports from twenty-eight patients upon whom he has performed pyloroplasty. In four of them gastric symptoms recurred, so that posterior gastroenterostomy was performed each time with satisfaction. These patients did not suffer from recurrence of stricture at the pylorus, but from fresh ulceration. Two other patients are no better than before the pyloroplasty, and should have further operative treatment. Ten others

[1] Boston Medical and Surgical Journal, 1905, vol. clii. p. 549.

[2] British Medical Journal, 1905, ii. p. 787.

[3] Ibid., p. 777.

have occasional attacks of stomach trouble, though they are considerably better than they were before operation. Twelve are perfectly well. Morison does not believe that gastroenterostomy will maintain its present reputation. When it is used he makes use of a bone button of his own device, as anastomosis thus carried out is easier, quicker, and simpler than by suture, which he formerly employed.

RESULTS IN FOUR CASES OF GASTROPTOSIS. Eve[1] reports four operations for gastroptosis. The first was a suspension of the stomach by sutures to the abdominal wall. The immediate improvement was not wholly maintained. In his next case he stitched both liver and stomach high up to the anterior abdominal wall. The improvement in this case was somewhat greater. In the other two cases he performed gastroenterostomy, because one patient has a dilated stomach with retention of food, and gave a history of hæmatemesis; and in the other case at operation there was a large cicatrix of the lesser curvature. The improvement of symptoms in these patients was very great indeed.

Diagnosis of Hour-glass Stomach. This condition is not so rare as it was thought to be formerly. Moynihan[2] has seen and operated upon nineteen well-marked examples. He calls attention to some new symptoms by which the diagnosis can be made. By means of the stomach tube three tests can be made. Wölfler's first sign, so-called, is the loss of a certain amount of the fluid which is poured into the stomach, because of its escape into the pyloric pouch. His second sign is the recovery of foul fluid from the cardiac pouch a few minutes after it has been washed clean. This is due to regurgitation from the pyloric to the cardiac pouch. A newer sign is that called " paradoxical dilatation." It consists in a splashing sound obtained in the pyloric pouch after the cardiac pouch has been washed and drained dry with the tube. There are four signs which may be elicited by the separate administration of the halves of a Seidlitz powder. In twenty or thirty seconds there will be an enormous increase in the resonance of the cardiac portion, but the pyloric portion will be unaltered. Later, as some of the gas passes the constriction in the stomach, a bubbling sound will be heard to the left of the median line. In the normal stomach this is heard at the pylorus to the right of the median line. Third, as the cardiac pouch lessens the pyloric will bulge. Fourth, in some cases a distinct constriction between the two pouches can be seen.

Gastric Dilatation and Movable Kidney. Atkins[3] thinks gastric dilatation a common affection, especially in women who have borne many

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[1] British Medical Journal, 1905, ii p. 774.

[2] Ibid., p. 767.   [3] Ibid., p. 793.

children; and that in most cases, even the atonic ones, there is more or less narrowing of the pylorus. This may be due to old ulcers, or to adhesions, or to a movable right kidney, which may either press directly on the pylorus, or may so drag upon the duodenum as to kink it. Whenever he finds gastric dilatation which is not plainly due to contraction of the pylorus he looks for movable right kidney and always finds it. He has found that fixation of the kidney will relieve these patients of all their gastric symptoms at once, and in time, under a properly regulated hygiene, diet, and strychnine, the stomachs have regained their lost motor and digestive functions, and have become nearly normal in size.

Gastroenterostomy by the Twine Triangular Stitch. Maury[1] has published another article fully describing his twine triangular stitch as employed in gastroenterostomy in dogs and humans. He now recommends the insertion of a complete continuous serous suture in addition to the twine triangular stitch. One-half of this suture is inserted before the twine triangles, and one-half afterward. If this is a necessary adjunct to the twine triangles, the time required for gastroenterostomy by Maury's method will be very little less than that required for gastroenterostomy wholly by suture, so that the field of the new operation will be very limited. It has two distinct disadvantages over the method by suture alone. One of these may be overcome by practice, the other never can be. The first is the necessity of inserting the stitches exactly right, and tying them very tight in order to produce complete sloughing. Practice may overcome this, though the number of tests upon man have not as yet demonstrated the fact very fully. The other disadvantage is the length of time needed for sloughing of the included tissues of stomach and intestine. This period, judging by the clinical histories of the patients who recovered, as well as the autopsy findings of those who died, seems to be at least three days, and it may be prolonged for a week. In some patients the twine did not pass by rectum for a number of days after the symptoms indicated the slough of the included tissues, but this is of course a minor consideration, as it is very unlikely that the twine loops, even though threaded through some living mucous membrane, would do any permanent harm. One Newfoundland dog licked his abdominal wound continually, and the hair which he swallowed formed a hair-ball around the ligature, a complication not to be looked for in the human subject.

Jaboulay's Modification of Murphy's Button. The modification of Murphy's button, suggested by the French surgeon Jaboulay, consists in a slit in the side of the button, so that each half may be screwed

[1] Annals of Surgery, June, 1905.

into the intestine through a very small slit not over one-half inch long. This is intended to do away with all sutures, both those to fit the intestine about the half button, and also reinforcing sutures after the halves have been pressed together. E. Beer,[1] who tested these buttons by using them to make fourteen anastomoses upon dogs, found that the introduction of these twenty-eight half buttons produced eighteen tears of the intestine, usually requiring suture. No reinforcing sutures were used, and one dog died from leakage. Only eight of the fourteen buttons cut their way out of the site of anastomosis. As tears and leakage have occurred with this button in the hands of its inventor, Jaboulay, it seems destined to displace neither Murphy's button nor anastomosis by suture, but to take its place on the shelf with a multitude of other ingenious but yet defective surgical appliances.

THE SMALL INTESTINE AND MESENTERY.

Surgical Anatomy of the Small Intestine. Monks[2] has continued his study of the small intestine, reference to which was made in PROGRESSIVE MEDICINE, June, 1904. The chief practical value of that previous study was the suggestion that the relation of a single loop of the small intestine might be determined in one of several ways, and that the upper end of any given loop can be told from the lower end by careful examination. The present study carries these details to more definite conclusions, and adds to our knowledge of the small intestine and mesentery in various other ways.

The mesentery is a flat structure whose root is about six inches long, but the "ruffled border" of which measures about fifteen feet. This "ruffled border" comprises scarcely more than the outer fourth of the mesentery. Its folds lie alternately to right and left from above downward (Fig. 24).

The surest way of telling which is the proximal end of a single loop of the intestine is to palpate the mesenteric root between the thumb and fingers.

"The loop of intestine is gently lifted from the abdominal cavity, and the assistant grasps its two extremities and holds it suspended horizontally. The surgeon, putting his thumb on one side of the mesentery and his first two fingers on the other, insinuates them slowly down toward the root of the mesentery, the slack of the mesentery being taken up by his other hand and by the hands of his assistant.

" By this method, which requires a little practice, the examiner can instantly determine, and this usually before he reaches the mesenteric

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[1] Annals of Surgery, 1905, vol. xlii. p. 744.
[2] Ibid., p. 543.

root, whether or not there is a twist in the mesentery. If there is a twist, it should be untwisted by rotating the loop of the bowel, and the mesentery again examined. When there is no twist of the mesentery, and the loop lies parallel with the mesenteric root, the upper end is the proximal end of the loop and the lower end the distal."

Another important point to which Monks calls attention is the existence of a distinct fold made by the mesentery as it descends into the pelvis from the lower end of the mesenteric root. He aptly terms it the pelvic fold of the mesentery. He has many times palpated it, both in the cadaver and during surgical operations. It is of distinct use as a landmark whenever one wishes to enter the great fossa on the left side

FIG. 24
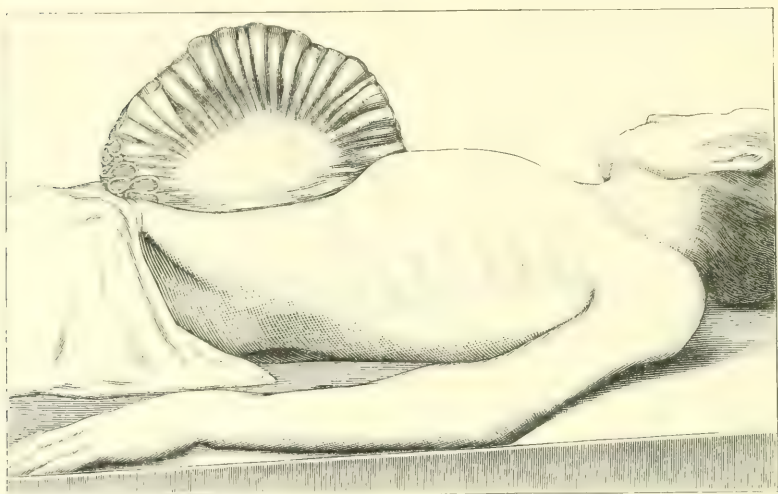
Showing the intestinal tube thrown into alternate curves, which are held in place by means of a stout copper wire within the gut. The alternating arrangement of the loops is most evident near the lower end of the ileum. The mesentery is flat up to the place where the ruffled edge begins. (Drawn with slight modifications, from a photograph.) (Monks.)

of the mesentery, as in irrigating the left side of the abdomen from an incision on the right side or in the median line (Fig. 25).

The pelvic fold of the mesentery is also of service in enabling the operator quickly to find the lower end of the ileum, as in a suspected typhoid perforation.

"The technique of this procedure consists in carrying the forefinger over the psoas muscle and the iliac vessels, keeping the finger-tip close to the parietal peritoneum, and so entering the pelvis. The finger is then turned on its own axis and hooked upward, the peritoneum at the back part of the pelvis being followed carefully. In this procedure the finger usually goes behind the ileum, entering the cavity on the left side

of the mesentery, where the finger comes against the lower end of that structure. The thumb and forefinger then close upon each other, grasping what is between them. When this is brought from among the coils of intestine, it will generally be found that it is a loop of the ileum, very close to the ileocecal valve. It is quite easy to do this, and to do it rapidly, in case the last part of the ileum hangs in the pelvis. When, however, it lies above the ileocecal valve, which appears to be the rule in about 50 per cent. of all cases, the manipulation just described is not always successful. A little practice on the cadaver, however, will usually enable one to trace out the lowest part of the ileum from its mesentery at the lower end of the mesenteric root."

Fig. 25
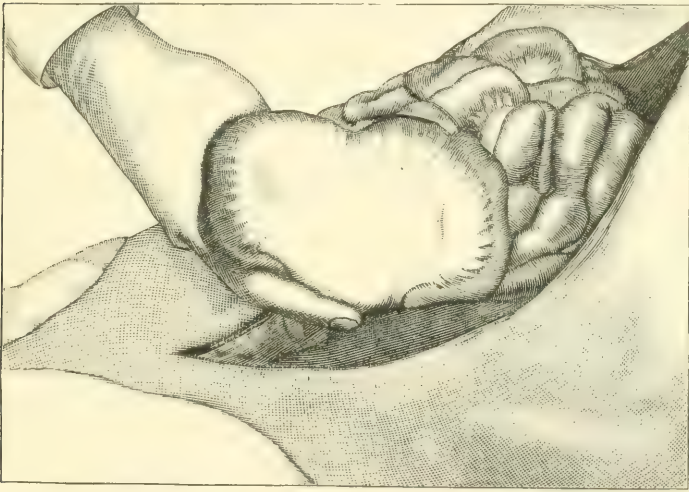
Showing the forefinger rounding the lower end of the ileum to reach the left side of the mesenteric root. The ileum and its mesentery are held up, so that the finger-tip may be seen.

These experiments also showed that it is impossible for more than a very short portion of the small intestine to empty itself through a single enterostomy wound. This is because of obstruction not only from sharp curves and kinks, but also from outside pressure on the tube, and still further, because the fluid portions of the contents are in the dependent loops, where they act as water-seals in traps to obstruct the passage of gases along the intestinal tube.

First Aid to Prolapsed Intestine. Andrews and Cock[1] report a case showing what excellent results may follow the intelligent use of the

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[1] British Medical Journal, 1905, ii. p. 627.

simplest means. A man aged sixty was found in a field near Gibraltar unconscious, and with three or four feet of long intestine prolapsed through a short wound in the left lower quadrant of the abdomen. He was carried a quarter of a mile to an outhouse of an inn, where boiling and boiled water were obtained, and the intestine washed and replaced. Some needles and unbleached muslin were obtained from a golf club nearby, and the wound was closed and drained. The patient was taken home the same night, another quarter of a mile away. He recovered without any symptoms, other than a slight local peritonitis. The wound gaped and was sewed in layers one week after the accident, proper instruments being then available. The patient recovered without ventral hernia.

Traumatic Intestinal Hemorrhage. Sauvé[1] mentions the occurrence of intestinal hemorrhage, following the reduction by operation of femoral hernia three days strangulated. The loop of intestine was congested, but not gangrenous, and its color improved at once. It was replaced in the abdomen and the wound closed. One week later, without rise of temperature, and with the pulse at no time over 100, the patient passed nearly two quarts of blood by rectum, making, however, a good recovery.

Sauvé found records of twenty-seven other cases of intestinal hemorrhage occurring in connection with strangulated hernia. The cases are naturally divided into immediate and delayed hemorrhage. The causes of immediate hemorrhage are violent attempts at reduction, rupturing a bloodvessel, and perforation of the intestine with hemorrhage. The causes of delayed hemorrhage are not quite so clear. The hemorrhage may come on within a few hours after reduction. The arterial ischæmia seems in these cases to have altered the walls of the capillaries and arterioles, so that they cannot withstand the increased blood supply after the strangulation is relieved. In other cases there has been gangrene limited to the mucous membrane, and the loosening of the slough has been followed by hemorrhage. Such hemorrhages have occurred from four to seventeen days after relief of the strangulation. Thrombosis and vasomotor paralysis have been assigned by other writers as causes of post-hernial hemorrhage.

Sauvé says that immediate hemorrhage may be avoided by abandoning utterly forcible attempts at reduction. If an immediate or delayed hemorrhage is recognized while in progress, ought the surgeon to operate? The answer to this question is to be found in the condition of the pulse, and the character of the stools. If the stools contain gangrenous material, recognizable by the gray color and foul odor, the hemorrhage is probably due to the casting off of mucous sloughs, and

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[1] Revue de Chir., 1905, vol. xxxi. p. 211, etc.

the patient will recover under the favorable influence of ice locally, and opium and ergotine internally. If the surgeon has overlooked a gangrenous patch extending to the peritoneum of the bowel, this favorable prognosis is not warranted, as perforation will result. If the stool is almost pure blood, and the pulse is very rapid, it is difficult to say whether or not operation should be performed, because the exact origin of such hemorrhage is in doubt. The patient is not in good condition for an intestinal resection and enteroanastomosis. And yet, this may be found to give the best results.

It is hoped that other surgeons will give their experience with postoperative intestinal hemorrhage, so that our knowledge of this condition may be increased.

Intestinal Obstruction Caused by a Gallstone. It is perhaps not as well known as it should be that intestinal obstruction may be due to a small gallstone. Robson in his book on *Diseases of the Gall-bladder and Bile-ducts* mentions cases in which a stone not more than an inch in diameter produced complete obstruction. In order to do so it must, however, set up inflammatory changes in the wall of the intestine, or peritoneum, or lead to a volvulus. Gordon and Wright[1] report such a case. The small intestine at the point of obstruction in their case was so friable that they had difficulty in making sutures hold. The exact size of the gallstone is not given.

Powell[2] removed an egg-shaped gallstone measuring one and onehalf inches in its longest diameter, and one inch transversely, from the ileum of a woman aged fifty-six years. It had caused complete obstruction of the intestine. The patient gave a history of attacks of biliary colic some eight years previously. Five days before operation she was seized with severe epigastric pain, and movements of the bowels ceased. For two days before operation there was stercoraceous vomiting. Recovery after operation was prompt.

GALLSTONE OBSTRUCTING THE SIGMOID. Milward[3] found the sigmoid flexure obstructed by a gallstone measuring $1\frac{5}{8}$ x $1\frac{1}{8}$ inches, which he removed by incising the wall of the bowel through a longitudinal band. Suture was difficult on account of friability of the tissue.

VOLVULUS FOLLOWING APPENDICITIS. Stirling[4] reports two cases of volvulus of the small intestine following operation for appendicitis, at intervals of nine days and seven weeks, respectively. In both cases perforation had preceded operation, and in one there was much pus in the pelvis, which in both cases was the site of the subsequently twisted loop

[1] Dublin Journal of the Medical Science, September, 1905, p. 182.

[2] Journal of the American Medical Association, 1905, vol. xlv. p. 1800.

[3] Lancet, 1905, ii. p. 1327.

[4] Intercolonial Medical Journal of Australasia, 1905, vol. x. p. 57.

of small intestine. Stirling sees in these complications an additional reason for early operation for appendicitis, before the spread of peritonitis sets up adhesions which may later produce intestinal obstruction in one or another form. Both of his patients recovered from the operation rendered necessary by the volvulus.

INTESTINAL OBSTRUCTION AFTER LABOR. T. P. Shaw[1] mentions an unusual cause of intestinal obstruction—namely, such pressure upon the pelvic colon from a blood cyst as to obliterate its lumen. The patient, a primipara, passed through a normal labor and puerperium until the fourth day. She was then seized with violent pain of the left side while at stool, which was only controlled by repeated doses of morphine. Symptoms of intestinal obstruction followed, and two days after the attack the abdomen was opened. There was a huge tense blood cyst of the left ovary, twisted on its pedicle, which was œdematous and thicker than one's wrist. The pedicle was untwisted, and the tumor removed, with relief of intestinal obstruction.

INTESTINAL OBSTRUCTION. *Treatment in Critical Cases.* J. W. Elliot[2] says that the mortality following immediate *enterectomy* in critical cases of intestinal obstruction—especially in those of a cancerous nature, is very high, 50 to 85 per cent. in our best hospitals. There ought not to be a mortality of more than 10 per cent. Mikulicz and others have approached this low mortality by freeing the affected bowel, bringing it outside the peritoneal cavity, which is closed behind it. Not until this is done is the bowel opened. Acting on this suggestion, Elliot has operated three times with success. In one case the obstruction was due to carcinoma, and in one to thrombosis of the mesenteric artery, and in one case there was intussusception of the colon from an unknown cause.

Elliot's conclusions are as follows:

1. The prevalent method of enterectomy with immediate suture in cases of intestinal obstruction, is attended with a high mortality on account of the changed condition of the distended bowel.

2. Enterostomy with later enterectomy is to be reserved for those patients unable to bear primary enterectomy.

3. Enterectomy with a temporary artificial anus should be the operation of choice in all critical cases of intestinal obstruction when there is an opportunity for resection, whether it involves the large or small intestine.

4. The suggested improvements in technique are these: The upper distended bowel should not be opened until the peritoneal cavity is closed. (This is already the practice of several surgeons.) The afferent and

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[1] Montreal Medical Journal, 1905, p. 28.
[2] Annals of Surgery, 1905, vol. xlii. p. 668.

efferent ends of the bowel should be stitched together on their mesenteric side before they are fastened into the parietal wound. This will greatly facilitate the later closing of the artificial anus. When the artificial anus is in the small intestine the partially digested discharge from it should be collected and injected into the efferent opening.

5. The closing of the artificial anus is a safe operation, and hardly disturbs the convalescence.

6. Up to the present time not enough cases have been done by this method to estimate its mortality, but the cases here reported, and others referred to, suggest the probability of better results than have been obtained by enterectomy with immediate suture.

INTUSSUSCEPTION IN CHILDREN. Hirschsprung[1] reports the result of treatment in 107 cases of intussusception in the Children's Hospital in Copenhagen from 1871 to 1904. Statistics covering years in the pre-antiseptic, antiseptic, and aseptic periods are not to be applied too rashly to the present age; but what he has to say of the necessity for early treatment is still true. Of these one hundred and seven children, seventy-seven were boys. All were well nourished; twenty-two were habitually constipated, and only nine gave a history of previous diarrhœa. In a great many instances either a fall or a blow upon the abdomen was the immediate exciting cause. Of the one hundred and seven children, sixty-five were cured, equal to about 61 per cent. The treatment which Hirschsprung recommends is chloroformization, taxis, and injection of water with some force. If this does not immediately succeed it is repeated. If it is still unsuccessful laparotomy is performed. In 84 cases it was possible to learn how long symptoms had existed previous to treatment in the hospital. Fifteen children were admitted in the first twelve hours after the onset; only one died, a mortality of 6 per cent. Twenty-eight children were admitted between twelve and twenty-four hours; ten died; a mortality of 36 per cent. Forty-one children were admitted after twenty-four hours; twenty-two died; a mortality of 54 per cent. Forty-four children were less than one year old. Among them the deadly influence of delay was even more striking as they showed a mortality of only 30 per cent. when admitted in less than twenty-four hours and 70 per cent. when admitted after twenty-four hours.

In the years 1871–1894 laparotomy was performed seven times, with one recovery; from 1895 to 1899 it was performed nine times, with two recoveries; and from 1900 to 1904 it was performed eight times, with two recoveries. It would be unfair, however, to compare the results of laparotomy with those of taxis and injection, as with few exceptions

[1] Mitteil. aus der Grenzgeb. d. Med. u. Chir., 1905, vol. xiv. p. 555.

laparotomy was only performed after taxis and injection in complete narcosis had failed to reduce the intussusception.

R. Jones[1] recently reported a case of a child aged two and a half years, who jumped from a barrow and was seized with abdominal pain and vomiting. The pain continued in paroxysms for four days with frequent stools consisting of blood and mucus, but no fecal matter. The abdomen was distended and very tender. Nothing further was learned by palpation. The diagnosis of intussusception was made. The child was inverted and a quart of olive oil injected into the rectum. This was followed by an injection of starch-water and tinctura camphoræ comp. No manipulation of the abdomen was attempted. Relief was prompt. All symptoms had subsided in two days.

Surgical Complications of Typhoid. PERFORATION. The chief interest in surgical operations for perforation occurring in typhoid fever centres about an early diagnosis. Meakins[2] calls attention to the fact that in spite of all that has been written on this subject, even the latest text-books still give as the symptoms of perforation, the symptoms of the resulting peritonitis. He has reviewed the records of the thirty-two cases of perforation which have occurred among 1230 typhoid patients treated in the Royal Victoria Hospital in Montreal in the last ten years. He admits the great difficulties of early diagnosis, and advocates a daily examination of every typhoid patient, with a record of the same. Too much reliance should not be placed on the nurse's notes, nor on the records of pulse and temperature as they appear on the chart. Often they do not alter for several hours. A blood examination is of no value in early diagnosis.

Pain is by far the most reliable symptom. It is nearly always sudden in onset, but its degree, duration, and location all vary. Severe unaccountable pains often occur in typhoid fever without perforation. Tenderness, especially when over the site of the pain, is the next most important symptom. Early local rigidity either in the right or left lower quadrant is to be looked for. Increased rate of respiration seems to be another important feature. The other physical signs are of secondary importance. If doubt exists it is far wiser to explore than to wait until it is too late. Experience has shown that an exploratory laparotomy in typhoid fever is attended with little risk.

It is with the greatest interest that we are able to compare these facts with those from Mt. Sinai Hospital in the city of New York. In the past two years in this hospital there were treated, according to M. Manges,[3] 216 patients suffering from typhoid fever. In this series there

[1] Intercolonial Medical Journal of Australasia, 1905, vol. x. p. 27.
[2] Montreal Medical Journal, 1905, p. 741.
[3] Journal of the American Medical Association, 1905, vol. xliv. p. 1016.

were no less than nineteen cases of perforation. Sixteen patients were operated upon and five of them recovered. Three patients were not operated upon. One recovered, and two died. Some may be inclined to question the diagnosis of perforation in the case of this patient who recovered without operation, but the symptoms were so similar to those of patients proved by operation to have perforation, that Manges is convinced of the correctness of the diagnosis.

Of all the symptoms, pain will always remain the most important. It was present in seventeen of the nineteen cases of the series, being absent only in the two delirious and comatose cases, and in fourteen it was the first symptom or onset. As this symptom deserves special attention it will be considered in detail later on. Of the condition of the abdomen, tenderness is a very varying symptom as regards extent, locality and severity. A far better guide is abdominal rigidity, which was present in sixteen cases, was variable in two and absent in one.

Distention is also an uncertain guide, as it was marked only in six cases, was slight in eight and absent in three; in some of the latter the abdomen was even retracted. Movable dulness in the flanks forms quite an important symptom, and was present in eight cases, absent in eight, and not stated in three. As to the obliteration of dulness, much would be gained from this symptom if physicians would make it a rule to note the variations in the size of the liver dulness throughout the disease. The time which is now wasted in examining the spleen during the course of the disease would be far better spent if devoted to the percussion of the liver and abdomen. The obliteration of the liver dulness is best noted in the axilliary line, since this area is less subject to disturbing factors from undue extension of the colon and small intestine. The time of the occurrence of the obliteration of liver dulness is variable. It may even be absent in cases of perforation in which free gas is localized in the peritoneal cavity by preformed adhesion. It was present in eleven cases, and was either absent or of doubtful value in eight cases.

Another series of 19 operations for perforations in typhoid fever is reported by G. L. Hays.[1] Eight of his patients recovered. He says that the diagnosis of perforation is easy, and that it is usually possible to make it even if the patient is delirious or is a foreigner. The typical symptoms are as follows:

Pain comes on suddenly, and is severe and continuous, although it may occasionally be intermittent. It is first noticed usually in the right cecal region and may be referred to the external genitals. The whole abdomen is usually tender on pressure. The right rectus becomes rigid,

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[1] Journal of the American Medical Association, 1905, vol. xlv. p. 1265.

and the rigidity later extends to the left rectus. The peristalsis is not much impaired at the time; in fact, it may be increased for a short period, but later it is lessened and finally is absent. Liver dulness in the nipple line is lost at varying times, depending on the distention of the bowel and the amount of free gas in the cavity of the abdomen. The facies is characteristic of one suffering severe pain and possibly shock. The shock is characterized by a blanched countenance, a pinched nose and a feeble, rapid pulse, and a subnormal temperature may be present. In his experience, in but few cases has there been a drop of temperature or a perceptible change in the pulse at the time of perforation. Slight nausea or vomiting is usually present. Whether the temperature has fallen or not it soon rises. This is due to a spreading peritonitis. The pulse increases in frequency, the rigidity of the abdomen and the tenderness is more marked and the facies is one of peritonitis.

The patient may have several evacuations of the bowels after the occurrence of perforation.

The three cardinal symptoms are, however, the sudden pain, the rigidity and the tenderness of the abdomen to pressure. These three symptoms being present in any case of typhoid fever, operation is indicated and demanded.

TYPHOID AND APPENDICITIS. J. H. Jopson[1] removed the appendix of a girl, aged eight, in the second week of typhoid fever. She gave a history of several previous attacks of abdominal pain and vomiting, which were probably appendical in origin. At the time of operation a diagnosis of intestinal perforation was made, but it was supposed, until the appendix was exposed and the perforation was found in its gangrenous tip, that a typhoid ulcer had perforated. The lumbar and pelvic regions were freely irrigated with saline. The wound healed by granulations, and the patient made a satisfactory recovery from the typhoid fever.

Kelly and Hurdon divide cases of appendicitis, occurring in connection with typhoid, into three classes:

1. Accidentally associated appendicitis, or arousing into activity of a latent or chronic inflammation by typhoid fever.

2. Appendicitis of mild or severe type arising from typhoid affection of the lymph glands, or ulceration of the appendix.

3. Appendicitis following typhoid fever within such a brief time as to suggest strongly a causal relation.

In Jopson's case the history of previous attacks, and the presence of a concretion in the appendix near the perforation, suffices to bring it

[1] Annals of Surgery, 1905, vol. xlii. p. 738.

into the first group as a chronic case aroused into activity by the typhoid inflammation.

The differential diagnosis between perforation of a typhoid ulcer and of the appendix is naturally not an easy one, nor has it practical importance. It is, however, of great importance at times to be able to distinguish non-perforative appendicitis and typhoid perforation; for the growing opinion among the best surgeons seems to be against appendectomy during typhoid if the operation can be safely postponed until the patient has recovered from the typhoid fever. Operation for appendicitis in the early days of typhoid is usually successful. The mortality is considerable if operation is performed later than the second week.

Infection of Gall-bladder in Typhoid Fever. S. P. Kramer[1] mentions an instance of *suppurative cholecystitis* as an immediate sequel or almost complication of typhoid fever. The temperature had only been normal a few days before it went up again as a result of infection in the gall-bladder. There was pain and vomiting and muscular contraction of the right side of the abdomen. Typhoid perforation was suspected. Instead there was found a gall-bladder greatly distended with pus. This was evacuated, together with thirty-five gallstones, from the centres of which were obtained pure cultures of typhoid bacilli. The patient survived operation by only six hours. She had before operation a great distention of the abdomen not relieved by rectal injections, and which was due to distention of the stomach. Kramer accidentally punctured the stomach, and utilized the wound to empty the organ. He emphasizes the necessity of preliminary lavage if abdominal distention is not relieved by rectal injection.

TYPHOID WITH ABSCESS OF THE SPLEEN. A. W. Harrington[2] has observed abscess of the spleen in two cases of typhoid fever. In one case the condition was unrecognized until revealed at autopsy, although the increasing size of the spleen had been noted. The other patient, a man aged thirty-three years, passed through a brief relapse and was recovering satisfactorily until the fifty-eighth day of the typhoid, when he complained of severe pain in the left hypochondrium with a temperature of 102°. This continued for some days until a swelling was palpable below the costal margin. A part of the twelfth rib was resected, and a small abscess of the lower end of the spleen was opened and drained. The patient's convalescence was again interrupted by osteomyelitis of the right femur requiring operation. The patient finally recovered.

From the pus in the spleen, and later from that of the femur, cultures of staphylococcus aureus and streptococcus were isolated.

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[1] Medical News, 1905, vol. lxxxvii. p. 1264.
[2] Lancet, 1905, ii. p. 1393.

TYPHOID WITH THREE INTUSSUSCEPTIONS. Another surgical complication of typhoid, and certainly a rare one, is mentioned by Bryant and Bragg.[1] The patient was a fireman, aged twenty-three years. The disease ran its usual course for nearly six weeks. Then one morning the patient was seized with pain in the right iliac region, with free perspiration, and a small movement of the bowels. The temperature was 102.3°, pulse 120 and weak, and respirations 24. The leukocytosis was between seven and eight thousand. As the condition did not improve, the patient was promptly transferred to the surgical side of

Fig. 26
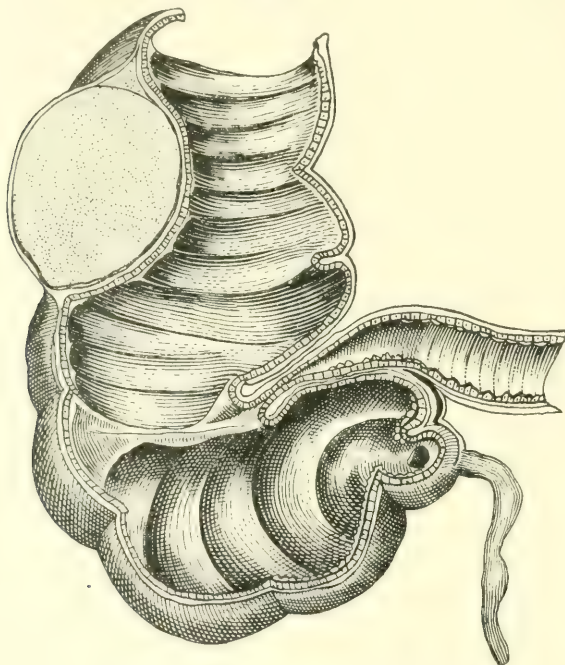
Dermoid cyst in wall of colon.   (Jepson.)

the hospital and was operated upon. " The incision was made one inch to the right of the median line. The abdomen was found filled with clear serum. The small intestine near the cæcum was deeply congested. On drawing out the small intestine a short distance from the ileocecal juncture an intussusception was found about eight inches long, invaginated both ways; this was easily reduced. A short distance farther on a second was found about five inches in length, also invaginated both ways; and drawing out more gut, there was a third intussusception about three inches long, invaginated from the right. Beyond this the

[1] Medical Record, 1905, vol. lxviii. p. 818.

gut appeared normal in color excepting the infiltrated patches and lymph nodes due to the typhoid infection. The incision was closed by through-and-through silkworm sutures. The pulse was then 150, and almost lost at the wrist. Hypodermoclysis of salt solution and stimulating enemata and other stimulants were given, but the patient did not rally from the shock, and died five hours later."

Dermoid Cysts of Intestine and Mesentery. Jepson[1] reports the removal of a dermoid cyst from the wall of the ascending colon of a woman aged thirty-two years. The cyst was covered by the peritoneum of the bowel, and pushed the mucous membrane and muscular layers into the lumen of the bowel (Fig. 26). The muscular layer seemed to be wanting in places, or at least it was much thinned.

FIG. 27
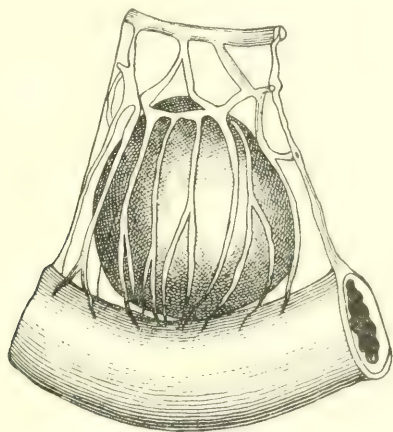
Dermoid cyst in mesentery. (Jepson.)

The other dermoid cyst which Jepson removed was situated in the mesentery, about forty-four inches from the ileocecal valve. This patient was a man. The cyst, which had been noticed by the patient himself for two years, had a diameter of four or five inches according to measurements made after its removal. Figs. 27 and 28 show well the different relations of such cysts to the intestine.

Mesenteric Cyst, with Acute Intestinal Obstruction. MacLaren[2] reports a case of this rare character occurring in a man aged sixty-five. After three days of vomiting and obstipation, he entered the hospital in a collapsed condition. The abdomen was opened and the obstructed loop of small intestine was found in the pelvis. It was brought upward, and was seen to contain a cyst somewhat smaller than the

[1] Surgery, Gynecology, and Obstetrics, 1905, vol. 1. p. 319.
[2] Montreal Medical Journal, 1905, p. 896.

first, which had produced an obstruction partly by traction and partly by twisting the intestine. It was situated in the mesentery and involved about one-quarter of the circumference of the bowel. It was enucleated, and the gap in the peritoneum closed by sutures. The cyst was of a serous character, having no lining epithelium. The patient recovered.

FIG. 28
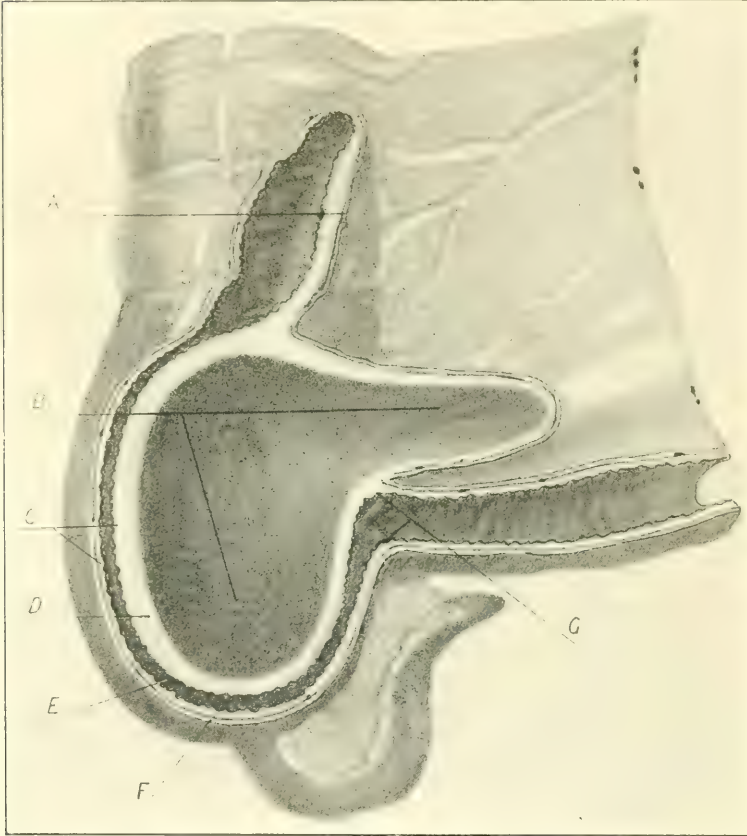
Cyst of mesocæcum : A, funicular process; B, cavity of cyst; C, mucous membrane; D, wall of cyst; E, cavity of cæcum ; F, intestinal wall; G, ileocecal valve. (Ayer.)

MESENTERIC CYST, PROJECTING INTO THE CÆCUM.   Ayer[1] describes an unusual form of mesenteric cyst which he encountered in a man aged twenty-three years.   For several years previous to operation he suffered from attacks of sharp pain in the ileocecal region, with vomiting and constipation, but very little fever.   A diagnosis of recurrent catarrhal appendicitis was made, but at operation the appendix was found to be

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[1] American Journal of the Medical Sciences, 1906, vol. cxxxi. p. 89.

normal. There was a fluctuating, smooth tumor as large as a duck's egg, and having somewhat its shape, situated in the posterior part of the cæcum (Figs. 28 and 29). The mass was at first thought to be an invagination of ileum into the cæcum, but as it could not be reduced, the cæcum was opened and the true character of the tumor was revealed. The cyst was incised and its contents—about four ounces of clear, viscid fluid—were evacuated. The cyst wall was so firmly adherent to adjacent structures that enucleation was deemed inadvisable. The portion of the cyst which projected into the cæcum was, therefore,

Fig. 29
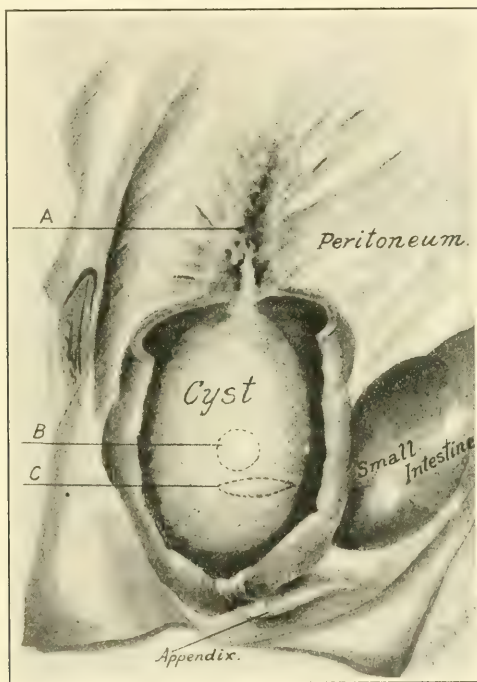
Cyst of mesocæcum exposed by removal of anterior wall of cæcum: *A*, mesocolic border; *B*, site of funicular process; *C*, site of ileocecal valve. (Ayer.)

excised and the cæcum closed by suture. The patient made a good recovery. Unfortunately neither the cystic fluid nor the excised portion of the wall of the cyst was preserved for examination.

The Value of Jejunostomy. Lempp[1] thinks that the value of jejunostomy has not been sufficiently appreciated, and that the operation would be oftener performed were this not the case. He discusses the problem in three classes of patients, namely, those having carcinoma of

[1] Arch. f. klin. Chir., 1905, vol. lxxvi. p. 323.

the stomach; those having gastric ulcer or some of its results, and those suffering from lesions of the stomach due to ingested caustics. The following are his conclusions with reference to jejunostomy in *carcinoma of the stomach:*

I. Jejunostomy is indicated: 1. In carcinoma with stenosis when neither resection nor gastroenterostomy is practical. 2. In carcinoma of the cardia when owing to the shrinkage of the stomach gastrostomy is not possible. 3. In carcinoma of both cardia and pylorus. 4. In carcinoma without stenosis when food causes great pain. 5. After perforation of a carcinomatous ulcer, in order to permit exclusion of the stomach. 6. After rupture of a carcinomatous ulcer into the intestine or externally through the abdominal wall.

II. As the necessity for jejunostomy is often not evident until the abdomen has been opened, permission to perform it if necessary should be obtained of the patient before the anæsthetic is taken in all cases of gastric cancer.

III. It is a good plan whenever possible to test the effect of excluding food from the stomach temporarily by keeping the patient for some days upon rectal alimentation. This is particularly important in cases of stenosis in which food in the stomach causes pain.

IV. When once the jejunal fistula has been established, all of the nutriment given the patient should be introduced by it; or at least the fistula should be preserved so that it can be used at any time that it is needed.

V. Jejunostomy should not be performed: 1. If there are severe complicating diseases, such as pneumonia or bronchitis, as such patients have no power to rally from the operation. 2. If rectal alimentation for a few days with complete rest of the stomach produces no cessation in the symptoms referable to the stomach, and especially if the pain continues unabated. 3. If there are extensive metastases in the liver, or in the peritoneal cavity, or in the lymph channels.

Jejunostomy has also a place in the treatment of non-malignant affections of the stomach, such as *ulcer and its complications.*

I. Jejunostomy is absolutely indicated if starvation threatens and no other remedial measure is possible.

II. It is the simplest palliative operation in cases of gastric ulcer, can be performed upon the weakest patients, and brings relief in every stage and in the presence of every complication.

III. Jejunostomy is the normal procedure. 1. In simple ulcer of the stomach not involving the pylorus, and so situated that stenosis is not likely to follow from its cicatrix. 2. In stenosing ulcer of the cardiac portion and in hour-glass stomach with an inaccessible cardiac portion. 3. Whenever the stomach is markedly contracted in consequence of

numerous ulcers, ulcerative gastritis, or perigastritis, and there are irritative symptoms present.

IV. Jejunostomy as a palliative operation should be performed in cases in which a more serious operation—resection or gastroenterostomy—is indicated, but the strength of the patient does not permit it to be carried out, for example: 1. In extensive callous ulcer. 2. In the presence of dangerous hemorrhage. 3. When there is a fistula between the stomach and colon, or other part of the intestine. In some of these cases the jejunostomy will probably prove a palliative measure only, to be followed later by the more radical procedure.

V. Jejunostomy is indicated in combination with gastroenterostomy. 1. If there is pyloric stenosis, and the marked irritability of the stomach (hemorrhage, etc.) makes a complete exclusion of this organ desirable. 2. If ulcer of the body of the stomach coexists with ulcer or stenosis of the pylorus.

VI. In cases of perforative ulcer of the stomach or duodenum, besides attending to the perforation itself, the surgeon should perform a jejunostomy in order to give the stomach complete rest. This is especially desirable if peritonitis is present.

VII. Jejunostomy may restore the health of the patient when resection or gastroenterostomy has failed of its purpose.

VIII. The fistula is temporary. Nourishment should be introduced through it till all symptoms have disappeared, and mouth feeding should then be gradually resumed. Not until this is fully restored and no abnormal symptoms are produced by it should the fistula be allowed to close. The total acidity of the gastric juice is a valuable test of the normality of stomach digestion in these cases.

Jejunostomy after Burns of the Œsophagus and Stomach: 1. The best treatment after burns of the œsophagus and stomach, especially of the pylorus, is the immediate performance of jejunostomy. 2. Not the character of the caustic swallowed, but the extent of the burned surface determines this. 3. If the stomach is much distended, a gastrostomy should also be performed in order to relieve the stomach of its foul contents. 4. The jejunostomy is only temporary. The stricture of the œsophagus resulting from the burns should be dilated by bougies, and the stenosis of the pylorus, if one forms, should be overcome by a plastic operation or by resection, or if these are impossible, a gastroenterostomy should be performed.

Technique of Jejunostomy. It is essential that the operation chosen shall be simple, so that it may be quickly performed under local anæsthesia if necessary, and that it shall give a continent fistula. Von Eiselsberg has adapted Witzel's principle for this purpose very successfully. An incision is made in the median line or through the left

rectus. The first jejunal loop is sought for as in a gastroenterostomy. This loop is brought out of the wound, placed in proper position, and the site of the fistula is chosen. This should be about 30 cm. (12 inches) from the duodenojejunal junction in order to ensure an easy attachment to the abdominal wall without tension. The intestinal loop is surrounded with gauze, and a short longitudinal incision is made through the serous and muscular coats. The mucous membrane is then seized with forceps and snipped with scissors, just enough to allow the passage of a No. 10 soft rubber catheter. The catheter is pushed into the descending part of the intestinal loop for about two inches. The open end of the catheter is clamped or stopped with a wooden plug. The catheter is then depressed into the intestinal wall parallel to its long axis, and exactly opposite the mesenteric attachment. A few Lembert stitches fix it in this position by bringing over it a fold of serosa and muscularis on either side, thus forming a canal about 3 cm. (1.5 inches) long. One or two stitches are also placed below the place where the catheter enters the intestine, so as to shut the canal tightly at that end. The patency of the catheter is tested by passing saline through it into the jejunum. The intestine is then fixed in the wound by four sutures of the intestine about the catheter to the parietal peritoneum. It is not necessary that the whole length of the canal should be extraperitoneal. The catheter may be fixed to the intestine by a catgut suture, or to the fascia. The abdominal wall is sutured in layers. In order to avoid kinking, the opening of the fistula in the abdominal wall should be one or two fingers' breadth below the navel; never above the navel. It is important to use only a single row of stitches in forming the oblique canal, as more than this may obstruct the lumen of the intestine. Such a fistula is perfectly continent, and will close of itself whenever the tube is left out.

THE APPENDIX.

An Early Diagnostic Sign of Appendicitis. Berardinone[1] has observed that in almost all cases of appendicitis there is enlargement of a single lymph gland, situated above Poupart's ligament, near the external ring. This gland is, of course, distinct from those of the mesoappendix, those of the ileocecal angle, and those along the superior mesenteric artery. All of these, as is well known, may be swollen in appendicitis, but the enlargement of this inguinal gland has hitherto escaped notice. The swelling reaches its maximum in forty-eight hours, the gland then being as big as a large pea, or a small cherry. It is tender on pressure,

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[1] Riforma Med., 1905, p. 1242.

and may give pain spontaneously if the swelling is marked, and if other more intense pain at the appendix does not mask this lesser pain. This glandular swelling is more noticeable in cases of appendicitis without symptoms of rupture, extra-appendical abscess, etc. Berardinone explains this as follows: When the peritoneal infiltration is considerable the pressure occludes the lymphatic vessels and prevents the infection from reaching this gland. When the infection is confined to the appendix the reverse is true. As the attack of appendicitis subsides, so does the swelling of the gland. Six cases of appendicitis were recently observed by Berardinone. The gland was enlarged in five of them. He has seen it enlarged once in six cases of enterosigmoiditis.

Observations by a number of surgeons ought very soon to determine whether Berardinone has added a reliable symptom to those already existing for the diagnosis of appendicitis.

DIAGNOSIS OF APPENDICITIS IN YOUNG WOMEN. Hooper[1] has observed sixty cases of appendicitis in women, and in no less than forty of them the disease of the appendix was associated with or mistaken for diseases of the pelvic organs. He has known instances of schoolgirls allowed to go on month after month dreading the menstrual period, morbid, invalided, always having headache and malaise, until finally an examination has shown that the appendix was infected, or was adherent to the pelvic organs. Considering the life that most school-girls lead, the frequency among them of appendicitis is not to be wondered at. Most of them take little exercise, drink little water, and are constipated. Boys of the same age are much better off in all these respects. During sixteen years' experience in a large boys' school Hooper saw only two cases of appendicitis, while in five years' experience with a large girls' school he saw seven cases. He believes that it is not sufficiently recognized how frequently appendicitis, both acute and chronic, occurs in young girls.

APPENDICITIS AND PELVIC INFLAMMATIONS. H. P. Jack,[2] after describing the lack of direct anatomical connection between the adnexa and the appendix, in spite of the attempts of some to establish this, says that none the less the two are clinically often related, and that inflammation in one part may extend to the other. Adnexal disease, due to appendicitis, is not nearly so common, however, as appendicitis following adnexal trouble. Such appendicitis, as a rule, consists of light adhesions to tumors, or to the uterus or its stump, or to the stump of an ovary or its tube, but there are instances of severe inflammation. It is often very difficult to make a differential diagnosis between appendicitis and adnexal disease, and it is necessary to bear in mind that

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[1] Intercolonial Medical Journal of Australasia, 1905, p. 449.
[2] New York State Journal of Medicine, 1906, vol. vi. p. 29.

appendicitis is appendicitis, and occurs just as frequently in women as in men. The history is often a great help in distinguishing these affections. In right-sided adnexal disease the pain is usually in the region of Poupart's ligament, lower down than in appendicitis. If there is tenderness and a mass to the left of the uterus, the probability that the disease is of the adnexa is great; but there are cases in which the appendix is in the pelvis, and under such circumstances a mistaken diagnosis is likely to be made. In cases of doubt it is better to make an exploratory incision than to delay a needful operation until a positive diagnosis can be made.

" Regarding the treatment, there are some points of special interest. If known two-sided pelvic disease exists, and appendical complications are expected, or in the case of tumors, the median incision is best. If appendical adhesions be light, they may be severed and the tumor removed and then the appendix, and this should always be removed if adherent, even though the adhesions be light. If the disease is limited to the right side, the semilunar incision gives a good exposure."

APPENDICITIS IN CHILDREN. C. N. Dowd[1] has made a careful study of seventy cases of appendicitis treated by operation by him, either in hospital or private practice, and compares them with a somewhat larger number of adults similarly treated by himself. He finds that children stand short operations well, and are more likely to recover from peritonitis than adults, but that long operations are to be avoided. He has received the impression that, on the whole, the percentage of severer grades of appendicitis is higher in children than in adults. He also notes the facts in regard to the peculiarities of appendicitis in children: (1) the rapidity and insidiousness of the disease are much greater; (2) that the percentage of diffuse and general peritonitis is greater, probably because the omentum is less apt to enclose the inflamed appendix; (3) that the pain is almost always present, but is more difficult to interpret; (4) that the vomiting is almost always present and is frequently many times repeated; (5) that the abdominal palpation in the majority of cases is as satisfactory or more satisfactory than in adults, but in a few cases is absolutely misleading; (6) that constipation is much less likely to be present; (7) that children have a greater ability to deal with general peritonitis than adults; (8) that during the acute progress of the disease delay is more dangerous than in adults, because of the insidious course of the disease and the greater tendency to peritonitis, and immediate operation is therefore to be advised.

CECAL TUBERCULOSIS MISTAKEN FOR APPENDICITIS. G. G. Turner[2] saw a woman aged thirty-four suffering from right-sided abdominal pain

[1] Medical News, 1905, vol. lxxxvii. p. 577.
[2] Lancet, 1905, vol. ii. p. 824.

and vomiting, and finding a small, tender mass in the iliac fossa, a diagnosis of appendicitis was made. When the abdomen was opened the mass was found to be in the outer and posterior wall of the cæcum. There were no enlarged glands. Two inches of ileum, the appendix, and the cæcum were removed. The cut ends of bowel were closed separately and a lateral ileocolostomy performed. Microscopic examination showed the growth to be tuberculous, with evidences of secondary septic activity. The patient had been in bad health for a year previous, but no evidence of tuberculosis of the organs could be found, either before or after this operation. Recovery from operation and an improvement in the general health was noted.

APPENDICITIS DURING PREGNANCY. Coe[1] finds that little attention has been given to the occurrence of appendicitis during pregnancy, possibly because the majority of cases are of a mild type. He says that one should " treat appendicitis in pregnant females in the same way as in the non-pregnant. In a mild case carry the patient through pregnancy if possible, and operate as soon as convenient after delivery, if the usual evidences of appendical trouble continue, since why should the woman be exposed to further risk during a subsequent pregnancy?

" If local pain persists, and especially if an induration can be felt, operate as in any other case.

" In the presence of perforation and abscess formation, operate without delay, disturbing the uterus as little as possible, and draining freely. It is desirable to suture the upper portion of the wound, if possible, or at least to plug it with gauze, firmly secured by strips of plaster, so that there will be no danger of extrusion of a loop of gut during labor. Opium would naturally be administered more freely than usual after these operations, to prevent uterine contractions. The preference in these cases is for the rectus incision, carried low down, in order to allow exploration of the pelvis. In perforation, with diffuse peritonitis after delivery, of course the median incision is preferable, with counter-openings at the most dependent points in the loins."

As toxæmia of pregnancy is often of intestinal origin, the plain duty of the accoucheur is to prevent this condition, not only by careful attention to the bowels (the use of laxatives and high irrigations) but by rigid supervision of the patient's diet, the restriction of meats, the cutting off of sweets and starches, and insistence upon the drinking of at least two quarts of water per diem. A number of cases are cited illustrating the various phases of this subject.

GANGRENOUS APPENDICITIS; DEATH FROM ACETONÆMIA. T. G. Atkins[2] gives a report of an interesting though fatal case of gangrenous

[1] Surgery, Gynecology, and Obstetrics, 1905, vol. i. p. 53.
[2] British Medical Journal, 1905, ii. p. 806.

appendicitis, occurring in a boy aged twelve years. The appendix was removed twenty-nine hours after the first pain, and fifteen hours after the rise in pulse and temperature. It was gangrenous, but not perforated. The wound was closed, and the boy did well for four days, without rise of temperature, and with normal action of the bowels. On the evening of the fourth day he became restless, screamed as in terror, and then became unconscious, with dilated pupils and oscillating eyes. The temperature was normal, and the pulse ranged from 86 to 114. The breath had a sweetened odor and, although there were no abdominal symptoms, the wound was reopened. No pus or peritonitis were found. There was still no fever, but the pulse went up to 126, and the urine had a sweet odor. On examination it was found to contain a large quantity of acetone. The patient died about twenty-four hours after the first restlessness was observed, the temperature having risen to 105° shortly before death. No autopsy was permitted. The death was evidently due to acetonæmia. The treatment was free purgation, normal saline under the breasts and rectal irrigation with saline.

WHEN NOT TO OPERATE IN APPENDICITIS. So many articles have been written on when to operate in appendicitis that J. E. Moore[1] thinks it time to gather together the few rules showing when operation should not be performed. He believes that operation should not be performed when the patient is evidently moribund. Nor should it be performed when the patient is evidently convalescing. This applies to cases in which the patient is first seen by the surgeon in the third, fourth, or fifth day, and the symptoms are improving. The risk of such patients going wrong without immediate operation is very slight. Either they recover entirely, in which case an interval operation is to be performed, or else an abscess forms which can be incised with less risk than an operation at the period mentioned. Moore admits that a good many surgeons will not agree with him in this, and that each case must be judged for itself. If appendicitis occurs in connection with severe la grippe, pneumonia, typhoid, or some other disease which makes the administration of a general anæsthetic hazardous, operation is to be deferred or limited to the opening of an abscess under a local anæsthetic. The fifth class of patients who should not be operated upon are those suffering from diffuse peritonitis. Moore believes that a greater number of these patients can be saved by opening abscesses locally, through the vagina or elsewhere, and by lavage and starvation, than can be saved by a radical operation.

H. A. Bruce,[2] on the other hand, who has had personal experience with over 400 cases of appendicitis, strongly advises immediate operation as

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[1] Journal of the American Medical Association, 1905, vol. xliv. p. 1976.
[2] Canadian Practitioner and Review, 1905, vol. xxx. p. 415.

soon as the diagnosis is made, unless there is some complication contradicting it. If competent surgical treatment is not available, the patient should receive only rectal alimentation. The stomach should be washed out and nothing should be given by mouth. This is also his treatment in cases in which operation is contraindicated and in all operative cases for two days after operation.

OPERATIVE TECHNIQUE IN APPENDICITIS. Maurice Richardson[1] thus describes his operation in acute appendicitis. "I make an incision of sufficient length through the outer border of the rectus, with especial reference to the tumor or other signs of localized or localizing peritonitis.

"It is of the utmost importance to open the abdominal cavity well within the area of infection. The moment the peritoneum is nicked I can tell whether there is a general infection. If the intestines are unchanged and there is little or no fluid, there is no general infection. If turbid serum spurts out under pressure, there is almost without a doubt beginning general infection.

"The next step is to cut through the peritoneum the full length of the external wound. Then the abdominal walls are lifted so that great masses of gauze can be used to protect intestines in all directions, radiating from the nidus of infection—the appendix. If used in sufficient quantity, the gauze will absorb all the fluid so that when it is removed the peritoneal cavity will be dry. Furthermore, the operator can see the exact situation of the appendix, its attachments, and the extent of suppuration and can perform intelligently an operation which in former days resembled nothing so much as the stirring together of small intestines, gangrenous appendix, and putrid exudations—an operation which it seems to me now a wonder that anybody survived.

"When the appendix has been isolated and tied, and before the soggy gauze masses are removed the permanent wicks are placed, usually a cigarette drain to the pelvis, and a plain gauze drain to the base of the appendix, the gauze masses are carefully withdrawn and the intestines fall back into place. No wiping and no irrigation are necessary. For twenty-four or forty-eight hours the wicks pour into the dressings enormous quantities of bloody serum. Then the track of the wick becomes isolated from the general peritoneal cavity. In three or four days it is removed and a shorter one substituted. This is removed in another week." In chronic appendicitis he employs the muscle splitting incision.

Of the *treatment in general peritonitis* he says: "I have tried irrigations in all forms. I have opened in the middle, on both sides, and

[1] Boston Medical and Surgical Journal, 1905, vol. clii. p. 334.

in both flanks as well as in front. I am fully convinced of the use-
lessness of these incisions, as well as the uselessness of irrigation, and
of enterostomies, and the worse than uselessness of evisceration
and the wiping off of every speck of fibrin. I believe that all
that human art can do in general peritonitis is to remove as large an
amount of infecting fluid as possible with the least shock possible,
trusting to the absorptive power of the peritoneum, and the strength
of the patients to do the rest."

Richardson warns against predicting a favorable outcome under pal-
liative treatment. Although he has had experience with thousands of
cases, he says he cannot predict the outcome of an acute case no mat-
ter how mild it may be, and cites, to prove this, recent instances from
his practice.

On the question of immediate operation *versus* delay R. H. Fitz[1]
says: "The physician is justified in delay until the conditions call for
an immediate operation. These may be present at his first visit, or
may not appear till a later period. If after twenty-four hours there is
no improvement, and especially if the fever increases, an immediate
operation is preferable to further delay."

II. A. Kelly[2] exposes the appendix and ties off its meson. A suture
of fine silk is laid around its base but not drawn tight. Just beyond
this the appendix is seized with crushing forceps and crushed, and just
beyond this it is also seized with ordinary artery forceps. The appendix
is then divided between the two pairs of forceps with the Paquelin
cautery. Gauze is then placed beneath the crushing forceps and the
cautery is applied to the line of their jaws until the visible portion of
the appendix has been burned away and the portion included in the
forcep's jaws has been cooked to a translucent substance resembling
gristle. This is inverted, after removal of the forceps, and the purse-
string suture drawn tight. A second Lembert suture is applied.

VARIATION IN OPERATION TO MEET UNUSUAL SITUATION OF THE
APPENDIX. A. S. Taylor[3] reports a case of appendectomy the interest
of which lies in the uncommon location of the appendix, and the fact
that its tip and base could not be reached through a single incision with-
out prolonging the same unduly. The base of the appendix was readily
found through an intermuscular separation, by turning up the cæcum.
Thence the appendix passed directly behind the cæcum, and its tip
could be felt high up to the outer side of the cæcum (Fig. 30).

The peritoneum was divided at the base of the appendix and an
attempt was made to enucleate the appendix with the finger. The
retrocecal part was readily freed, but it soon became evident that the

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[1] Loc. cit.   [2] American Medicine, 1904, p. 1123.
[3] Medical News, 1905, vol. lxxxvii. p. 590.

upper parts could not be dealt with in this manner, as the method was blind and did not give sufficient control of any hemorrhage that might occur. The incision was, therefore, continued upward through the skin and external oblique muscle, and a second entrance made into the peritoneal cavity through the transversalis muscle. Through this second opening the appendix was freed and its peritoneal attachments ligated, and the patient was saved from the ventral hernia which would almost certainly have followed a division of the fibers of the transversalis muscle throughout the length of the skin incision.

Fig. 30
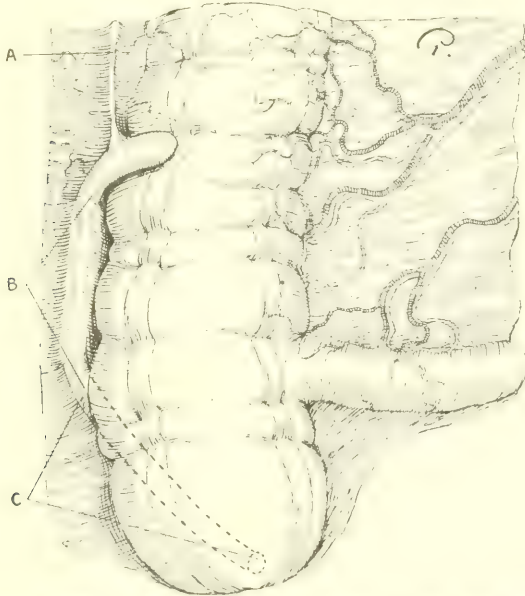
A, peritoneal fold running upward from mesoappendix to liver; *B*, retroperitoneal portion of appendix; *C*, retrocecal portion of appendix. (Taylor.)

CONDITION OF PATIENT AFTER THE APPENDIX HAS BEEN REMOVED. L. Jones[1] undertook to learn the late condition of patients from whom the appendix was removed in St. George's Hospital in the years 1900, 1901, and 1902. He obtained eighty-seven replies to about twice as many letters. Some of these patients had peritonitis at the time of operation; some an abscess confined to the appendix, while some of the operations were performed in the interval between attacks. Taking all the patients together, fifty-four of the eighty-seven have been perfectly well since operation; twenty-seven have had in general good health, but have had occasional symptoms in the vicinity of the wound,

[1] Lancet, 1905, ii. p. 1613.

and six have had symptoms which they ascribe to the operation. Three of these have ventral hernia in the scar; two have occasional severe pain, and the sixth ascribes to the operation symptoms which probably could not have been produced by it—viz., a double inguinal hernia.

It is interesting to note the subsequent history of seventeen patients whose periappendical abscesses were opened without removal of the appendix. Two of them had subsequent acute attacks with operation and removal of the appendix. Nine are in perfect health, never having had another attack. Six of them have had more or less pain at times, but not enough to seriously inconvenience them. These are included in the twenty-seven who have had mild symptoms.

THROMBOSIS OF THE LEFT EXTERNAL ILIAC VEIN FOLLOWING APPENDECTOMY. Witzel[1] reports three cases of this rare sequel to the removal of an appendix. He finds its cause not in any intra-abdominal condition but in the simultaneous ligature or inclusion in the suture of the right epigastric vein and artery. Following this the tissues overlying the right rectus became very blue and the thrombosis gradually extended up the left epigastric veins and then to the left external iliac and femoral.

PAROTITIS AFTER APPENDECTOMY. Bowe[2] has seen acute parotitis following removal of the appendix in two instances. In one case there was no abscess outside of the appendix, and the wound healed promptly per primam. On the fifth day the right parotid began to swell, and on the tenth day it was incised and much pus escaped. In the other case the appendix was removed with difficulty on account of spreading inflammation. The wound was drained. On the third day the right parotid and adjacent tissues were markedly swollen. The left soon became involved. The patient died on the fifth day after showing pronounced symptoms of septicæmia.

MALPOSITION OF THE APPENDIX. Blake[3] is of the opinion that many of the indefinite attacks of discomfort in the right lower quadrant of the abdomen are due to some malposition of the appendix. He notes especially the influence of a short mesoappendix in producing traction upon the cæcum. Such patients are benefited by operation, even though at operation no evidences of inflammation are found. He cites several cases in support of this view.

Tumors of the Appendix. ENDOTHELIOMA. Sargent[4] reports an attack of appendicitis occurring in a girl aged twelve. He removed the inflamed

[1] Centrabl. f. Chir., 1905, p. 737.
[2] Annals of Surgery, 1905, vol. xlii. p. 735.
[3] Ibid., p. 394.
[4] Lancet, 1905, ii. p. 889.

appendix three weeks after the onset of acute symptoms and found its distal half much distended beyond an obstruction to the lumen. The obstruction was a small spheroidal tumor found on microscopic examination to be an endothelioma. The patient recovered. This rare case has its counterpart in the common obstruction of the large intestine by a carcinoma.

L. K. Baldauf[1] reports three cases of *carcinoma of the appendix* from the records of a single pathological laboratory. His very complete article also contains abstracts of some thirty-one other cases reported by different observers. His conclusions are:

1. Primary carcinoma of the appendix is present in from 0.3 to 1 per cent. of the appendices removed at operation; its discovery at autopsy is very unusual.

2. It is a tumor of early life, occurring usually between the ages of ten and forty, the largest number being in the third decade.

3. It occurs with equal frequency in either sex.

4. Acute or chronic inflammatory lesions are usually present and are responsible for the symptoms demanding operation; the tumor itself while localized gives rise to no pathognomonic symptoms.

5. Direct extension to other organs and metastasis are rare.

6. The usual type is the simple alveolar cancer; adenocarcinoma occurring next in frequency, while colloid cancer is unusual.

7. Conclusive information concerning the relation of this lesion to other diseases of the appendix can only be obtained by the careful routine histological examination of all appendices removed at operation.

The Appendix as a Drainage Tube. APPENDICOSTOMY. Keetley[2] reports two cases in which he followed Weir, and utilized the appendix as a tube through which to inject fluids into the colon, with complete satisfaction. One patient was an infant not quite two years old, suffering from an invagination of cæcum, appendix, and part of the ileum into the ascending colon. This was reduced, the distal portion of the very long appendix removed, and its stump utilized for colonic irrigation. A fortnight later this stump was resected and the wound closed. The other patient was a girl of fifteen, who for years had been very constipated, sometimes going for two weeks without defecation. At operation the transverse colon was found to be so stretched that it reached to the pubes. The appendix was opened and fixed in an inguinal wound. Through it a soft rubber catheter was daily passed and a pint of warm water injected. This sufficed for a movement. After the first few days the patient herself attended to this treatment, which at the time of report had been kept up four months, with

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[1] Albany Medical Annals, Dec., 1905.
[2] British Medical Journal, 1905, vol. ii. p. 863.

complete relief of headache, etc. Keetley purposed to maintain the appendicostomy for a good while in order to give the colon time to regain its normal position and condition. There was no leakage from the opening in the appendix.

W. Meyer[1] reports five cases in which he performed appendicostomy for the sake of flushing the colon in patients suffering from various chronic affections of the large intestine, catarrhal, tuberculous, specific, and amœbic. These cases disprove the fear entertained by many that irrigation through such a small tube would not be satisfactory. Meyer found that two quarts of fluid introduced through a tube 14 mm. in circumference passed through the whole large intestine in ten minutes. In view of the obstinacy of ulcerative colitis in its various forms and its tendency to recurrence the author is right in insisting that the communication with the caput coli shall be kept open for a considerable time, and that in conjunction with the colonic flushing, rational internal medication and a suitable diet shall be employed.

THE LARGE INTESTINE AND RECTUM.

Volvulus of the Cæcum. The subject of *Intestinal Obstruction* was discussed at length in PROGRESSIVE MEDICINE, June, 1905, and on page 88 was a review of Faltin's article on volvulus of the cecum. The mortality of this form of volvulus is very high. Detorsion according to Faltin was practiced fifty-nine times with twenty-eight recoveries, and resection nine times with three recoveries. Corner and Sargent,[2] writing more recently upon this topic, give a report of five cases occurring in their practice at St. Thomas' Hospital, London. Resection was twice performed, with two deaths. Detorsion was performed once, with one death. In two other cases operation was begun, but not carried to the relief of the twisted cæcum. Both these patients died. These writers believe that cecal volvulus is commoner than is generally supposed, and that partial twists may explain some of the attacks of right-sided abdominal pain now almost invariably ascribed to the appendix. A. C. Wood[3] reports a single case of cecal volvulus treated by resection, with death from extensive gangrene of the ileum above the point of resection. Additional statistics are much needed to indicate the best method of treatment in those cases in which the validity of the intestinal wall is doubtful, or even worse.

G. A. Syme[4] reports a successful resection of the cæcum for volvulus.

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[1] Medical News, 1905, vol. lxxxvii. p. 385.
[2] Annals of Surgery, 1905, vol. xli. p. 63.
[3] American Journal of the Medical Sciences, 1905, vol. cxxx. p. 1007.
[4] Intercolonial Medical Journal of Australasia, 1905, p. 321.

The ileum was implanted laterally in the ascending colon, and the abdominal wound was closed at once. The symptoms of obstruction had lasted three days, and the cæcum at operation was apparently gangrenous.

INTUSSUSCEPTION OF THE COLON. R. H. Russell[1] has observed three cases of intussusception of the large bowel in children. Early and rapidly increasing distention was characteristic of all three cases, and was much more marked than the distention that occurs with ileocecal invagination. Distress is slight. The child does not look ill and complains of little pain, and blood is not necessarily passed by rectum. Again, no tumor may be felt if the invaginated portion is under the ribs. One of the three patients died without operation; one was operated on too late, while in the third case, the only one of the three in which Russell was in control, operation was performed promptly, and an intussusception of the colon in the left hypochondrium was easily reduced, and the child recovered. This patient had vomited blood, an unusual symptom, and one which somewhat obscured the diagnosis.

Angulation at the Sigmoid. Delatour[2] describes angulation as a condition of the sigmoid in which the intestine is so bent on itself that its lumen is obstructed. Several cases are reported, in two of which this condition was absolutely demonstrated. In one of these the angulation occurred at the upper end of the sigmoid, and in the other at its lower end. Delatour believes that angulation and not a twist of the sigmoid has been present in many cases called volvulus, in which reduction has been accomplished without operation, or in the first manipulation after opening the abdomen. The treatment he recommends is rectal injection with the patient in the knee-chest position; and if this fails, an artificial anus is to be made in the cæcum. Not many surgeons will agree with this operative treatment, which may effect a cure in cases of angulation, but would be unfortunate treatment if the case proved to be true volvulus of the sigmoid or a carcinoma of the sigmoid or rectum.

Rectal Tampons for Constipation. MacMillan[3] has used rectal tampons, as a means of curing constipation, with great success. Either absorbent cotton, cheese-cloth or lambs' wool may be employed, but the tampon should be of such size as to cause some stretching of the bowel. It can be inserted through an ordinary proctoscope and packed into place by means of a long forceps. It is provided with a cord for its removal, and is smeared with vaselin.

The size of the tampon and the length of time it should be retained depend upon the degree of atony in the particular case. From two to

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[1] Intercolonial Medical Journal of Australasia, 1905, p. 291.
[2] Annals of Surgery, 1905, vol. xlii. p. 678.
[3] Medical Record, 1905, vol. lxviii. p. 979.

six hours is generally sufficient.   If a tampon is used between two and three in the afternoon and withdrawn at seven or eight in the evening a constipated movement will generally occur the following morning. Occasionally there is a movement when the tampon is withdrawn. The efficacy of the treatment is early made manifest by the fact that in nearly every instance there is a bowel movement also on the second morning.   These movements are at first usually deficient in amount. In the great majority of cases he begins by using a tampon on alternate days, and as progress is noted increases the time between treatments.

Many of the patients were permanently cured by treatment for a few weeks.   The tampons are placed in a portion of the bowel which normally contains solid material.   They are, therefore, a suitable means of stimulating peristaltic action of the lower bowel.   Fluid, on the other hand, is not normally found in this part of the intestine, and hence the lack of curative action in the use of rectal injections.   The tampon should be placed in that portion of the bowel in which distention is known to provoke normally the powerful peristaltic contractions which lead to evacuation—viz., in the rectosigmoidal junction.

Rectal Operations under Sterile Water Anæsthesia.   A. B. Cooke[1] advocates the use of sterile water to produce local anæsthesia when operating for the following cases: *Internal* or *external hemorrhoids, anal prolapse* and *anal fissure.*   He has performed twenty-five operations falling into these four groups, using no anæsthetic other than sterile water, and in consequence he is convinced that this method, first advocated by Gant, is a notable advance in rectal surgery.   Pain at the time of operation is said to be exceptional, and postoperative pain is inconsiderable; while confinement to bed is 50 per cent. less than is the case when other methods are employed.   His final claim for the method is that it robs a rectal operation of its terrors for the patient, and in nowise interferes with the thoroughness with which it is performed by the surgeon.

This all sounds very attractive, but nevertheless suggests the talk of the doctor who calmly assures his patient that the lancing of a boil will not hurt.   About a year ago a well-known surgeon who submitted to operation for a small hemorrhoid at the office of a sterile water enthusiast told me he went to bed and suffered for two days afterward. His idea of the method was given in language too picturesque to repeat. But, then, doctors are proverbially bad patients.

Prolapse of Anus and Rectum.   C. Hoffmann[2] disputes the Esmarch theory of rectal prolapse that the mucous membrane of the anus first prolapses and then gradually that of the rectum follows.   He says hemorrhoids, etc., are mere coincident and not a cause.

[1] Medical News, vol. lxxxvii. p. 392.
[2] Centralbl. f. Chir., 1905, p. 905.

Nor does he agree with Waldeyer, who looks upon rectal prolapse as due to intra-abdominal pressure, and therefore a form of hernia. He says its prime cause is a weakened pelvic floor. Operation, therefore, should be directed toward strengthening this structure. His operation for this purpose is similar to Tait's perineorrhaphy. He makes a transverse incision midway between the anus and coccyx, and at either end of this an anteroposterior incision extending forward a little beyond the anus and backward as far as the coccyx. These incisions are made two inches deep (4 to 5 cm.) and the hemorrhage is considerable. When this has been stopped the wound is pulled apart, front and back, and sutured in a single anteroposterior plane with several rows of buried sutures of catgut or wire and a row of wire stitches in the skin. The results are said to be very good.

Plastic Operation for Stricture of the Rectum. H. A. Lothrop[1] relieved a patient of an annular benign stricture of the rectum just above the anal canal by the following operation: The patient was prepared by several days' diet upon fluids other than milk, free catharsis, and vaginal and rectal irrigation. The sphincter ani was fully dilated. A curved transverse incision was made between the anus and vulva, and the vagina and rectum were separated to a point well above the stricture; a vertical incision was then made through the stricture in the anterior wall of the rectum for a distance of 2.5 inches, and through this the posterior rectal wall was similarly incised and freed. The posterior vertical incision was sutured transversely with 1.5 interrupted sutures of No. 1 chromic gut; the anterior incision was similarly sutured and the skin wound closed. The lumen of the rectum then readily admitted three fingers. A large plug made of rubber tubes and gause and covered with thin rubber was inserted and removed in four days. The wound united firmly, and although there was a little contraction in six months, the lumen had not further decreased in a year, and at that time the finger passed the site of stricture with a little force.

Removal of a Rectal Tumor. Mummery[2] removed a large papillomatous tumor showing epitheliomatous change from the posterior wall of the rectum of a man aged 63. The growth was about four inches above the anus. The incision employed was in the median line commencing an inch above the anus and extending to the sacrum. The coccyx was removed. The portion of rectal wall removed measured three square inches. The gap was closed by two layers of sutures and the parts united without producing any stricture.

Cancer of the Rectum. There was a discussion of this subject at the last meeting of the British Medical Society, which was notable on

[1] Boston Medical and Surgical Journal, 1905, vol. clii. p. 477.
[2] Lancet, 1905, ii. p. 888.

account of the large number of surgeons who took part in it, and no less so for the divergence of their views in important points of treatment. Several mentioned with satisfaction that the medical men were earlier directing such patients to the surgeons, but to encourage still further this life-saving practice, the essentials of an early diagnosis were emphasized.

DIAGNOSIS. E. S. Bishop said that the cardinal symptoms at an early stage are: (1) Pain either in the rectum or its vicinity, or in the abdomen or groins, or thighs; (2) the passage of mucus and blood by rectum, often with tenesmus; (3) some irregularity in defecation, such as steadily increasing constipation, or alternating constipation and diarrhœa; or incontinence of feces if the growth is low down. Vomiting and disturbances of micturition are late symptoms. S. Edwards said that no symptom of rectal trouble, however slight, should be neglected by the practitioner. The bowel should be evacuated, and then examined, first with the finger and afterward with Strauss' aeroproctoscope. This does not entail anæsthesia, and permits the inspection of the whole rectum and part of the sigmoid colon. Other surgeons also commended the use of this instrument for diagnosis.

PRELIMINARY TREATMENT. Charles Ball emphasized the importance of a thorough preliminary evacuation of the bowel. He administers purgatives four or five days previous to operation, and continues them until the day previous to operation, when a copious enema should completely empty the colon. The patient meanwhile is well fed with food that will leave little residue, and the night before operation a full dose of an opiate is given to check peristaltic action. Two hours before operation another enema may be given. When the patient is under ether, the rectum and lower part of the colon are washed out with a 2 per cent. solution of creolin or some other antiseptic. Ball does not perform preliminary colostomy in cases in which this preliminary treatment can be satisfactorily carried out. If this is impossible for stricture or other cause, colostomy is necessary.

Henri Hartmann never employs preliminary colostomy.

F. S. Edwards favors preliminary colostomy in all cases in which the peritoneal cavity is to be opened. It is essential in cases in which the bowel cannot be thoroughly emptied by purgatives and enemata.

E. S. Bishop advocated preliminary colostomy in all cases. What plumber, he said, would attempt to remove and reunite sections of piping unless he had first turned off the gas or water circulating through them. If when the colostomy is performed the descending colon is drawn as far as it will come the colostomy will not impede the descent of the gut when the rectum is excised. The additional comfort and safety to the patient and surgeon, which is due to the keeping clean the field of operation upon the rectum is very great.

Sinclair White avoids colostomy in elderly patients if the disease is recent; in all others he performs it, and keeps it open for at least a year, as it is a great relief in case of recurrence.

E. Deanesly said that if the anus is involved in the growth and has to be sacrificed, there is much to be said in favor of a preliminary permanent colostomy; otherwise he did not recommend it.

C. Ryall has never had recourse to preliminary colostomy, and has had no occasion to regret it.

CHOICE OF OPERATION. It was generally agreed that perineal resection, formerly more popular, should now only be employed in cancer of the anal canal.

C. Ball said that a modified Kraske operation, with transverse division of the fifth sacral vertebra and removal of this part of the sacrum and the coccyx is the most satisfactory sacral operation. Sometimes he opens the peritoneum early, sometimes not until he has freed the rectum. The bowel itself is divided first above the tumor or below it, or in some cases directly through it, according to the necessities of the dissection. When this removal has been accomplished, the surgeon must decide upon either end-to-end suture or sacral anus, or upon bringing the upper cut end of the bowel through the normal anus. He has not had frequent success with end-to-end suture, but when it does hold it gives a most satisfactory result. If it is attempted, movements of the bowel should be early produced by salines. A sacral anus is unsatisfactory. He is convinced that he formerly terminated the operation in this way in many cases in which he might have brought the upper bowel out of the anus. This was first advised by Moulonguet in 1890. The anus is dilated, shorn of its mucous membrane and skin, the upper bowel is freed by cutting its posterior attachments and brought down through the anus and stitched in place. It is well to leave the ligature on the upper bowel for forty-eight hours, to permit the formation of adhesions, before the wound becomes soiled with feces. The invaginated gut sloughs in some cases, but if this is not too extensive it will not defeat the object of operation.

Excision of the rectum by the abdominal route, although performed by Czerny in 1883, has not yet assumed the position in surgery to which Ball believes it entitled. Its advantages are four. 1. After the abdomen is open it is possible to estimate the extent of the disease, the degree, if any, of lymphatic and peritoneal involvement, so that the radical operation can be carried out, or colostomy performed, or all operation abandoned, according to circumstances. 2. The early division of the superior hemorrhoidal artery in the mesocolon and of the middle hemorrhoidals at an early stage makes the operation almost bloodless. 3. A complete removal of infected lymph glands is more likely by this

method.   4. The bowel is secured and tied above and below the tumor, so that wound soiling is minimized.   The steps of operation are as follows: The patient is placed in a Trendelenburg position, as nearly vertical as possible, in order to bring the intestines out of the pelvis and to give plenty of room.   A long incision is made through the left rectus muscle. If the tumor is movable and the peritoneum not involved, operation is justifiable.   The pelvic colon is drawn out and the point selected at which its meson is the longest.   If it measures six inches it will readily reach to the anus when divided.   If much shorter than this the case will have to terminate in permanent colostomy.   The colon is crushed in two places, ligated and divided, and the cut ends wiped with pure carbolic and wrapped in gauze.   The meson is divided between clamps down to its attachment, and the attachments of the lower piece are ligated and divided piece by piece, and when the rectum ceases to have a complete peritoneal involvement the peritoneum is divided in front of it and the dissection continued to the pelvic diaphragm.   If possible a ligature is placed below the seat of disease and an assistant washes out the rectum and anal canal up to the ligature.   It is then divided below the ligature, the mucous membrane is dissected from the anal canal and the upper cut end of bowel is invaginated through the anus and stitched there.   If drainage is thought desirable, gauze or a tube may be inserted through an incision made near the tip of the coccyx.

If the cancer is above the anus, Hartmann always operates as follows: The anus is closed with a purse-string suture.   The incision begins behind the scrotum, divides at the level of the anus which it surrounds, and continues on the left side of the coccyx.   He then inserts his finger in front of the sacrum and pushes forward the rectum and involved glands.   The rectum is then freed in front from the urethra and prostate.   It is then only fastened by the levator ani and the fascia sacrorectogenitalis.   These parts are cut with scissors from back to front, and as the rectum is drawn down the peritoneum is opened.   The operation is then an easy one.   As the rectum is drawn farther down the vessels of the mesorectum are tied, the bowel is cut through between two elastic forceps beyond the tumor, and the upper cut is sutured in the skin. He has had twelve recoveries in twelve cases.   Three had recurrence in six, seven, and eight months.   The nine others are living without recurrence after five and one-half years, two years, eighteen months, sixteen months, and fifteen months.   Others are too recent to judge.

LATE RESULTS AFTER RESECTION FOR CARCINOMA OF RECTUM.   Hartwell[1] gives a resume of forty-six cases of carcinoma of the rectum excised by various surgeons in different hospitals of New York City,

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[1] Annals of Surgery, 1905, vol. xlii. p. 399.

including in the list, the report of two patients operated upon by himself. The immediate and late results were as follows: Twelve patients, or 26 per cent., died from the operation, one-half of them from sepsis. Nine patients, or 20 per cent. of the whole number, died from recurrence or some other disease within three years after operation. Ten others were living, free from disease at various periods after operation, but less than three years. Five patients, or about 11 per cent. of the whole number, had safely passed the three-year period. Hartwell thinks that one may safely add to this number two others from the list of ten recently operated upon, thus giving an estimated cure of seven out of forty-six, or 16 per cent. These figures are far less hopeful than those reported by individual surgeons, but they will appeal to many as being nearer the truth. Hartwell is an advocate of a preliminary colostomy, which he thinks should be made permanent. The surgeon will then be free to remove all the rectum from above the growth to and including the anus, and thus increase the chance of a complete removal of all cancerous tissue.

CARCINOMA OF THE RECTUM IN THREE SISTERS. C. P. Childe[1] gives an account of the occurrence of cancer of the rectum in three sisters, all between the ages of thirty and thirty-five years. In two of them the malignant disease was preceded by multiple polypoid adenomata of the rectum, extending as high up as the finger could reach. The third sister had also carcinoma of the rectum, but without the preliminary polypoid condition. The question of the contagiousness of such a disease is not unnaturally raised. Although these three sisters were all living out in different families, they visited each other from time to time, and when doing so usually slept in the same bed. Childe collected reports of other cases of multiple polypoid adenomata, making, with his two cases, fourteen in all. He found a tendency for the disease to appear in more than one member of a family; that almost all of the cases were in women (87.5 per cent.), and that in four of the fourteen cases the termination of the disease was in carcinoma.

THE LIVER AND BILIARY PASSAGES.

A Method of Covering Raw Spaces in the Liver. J. Frank[2] has suggested a method of obliterating raw spaces in the liver and thus controlling hemorrhage and promoting healing. If there is a fissure in the liver without loss of substance, almost any suture which approximates the surfaces of the wound and leaves no dead spaces will answer.

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[1] British Medical Journal, 1905, ii. p. 804.
[2] Journal of the American Medical Association, 1905, vol. xlv. p. 446.

But when a portion of tissue is torn away, or has to be cut away to get rid of a tumor, it is difficult to cover the resulting wound on account of the lack of elasticity of hepatic tissue. Frank accomplishes it by making gutters of the wound surfaces through resection of the inner hepatic tissue, being careful to preserve all the upper and lower peritoneal parts. It is then possible to suture together the upper and lower surfaces without too great tension, as shown in Fig. 31.

Frank proved the correctness of this principle by experiments upon eighteen dogs.

Fig. 31
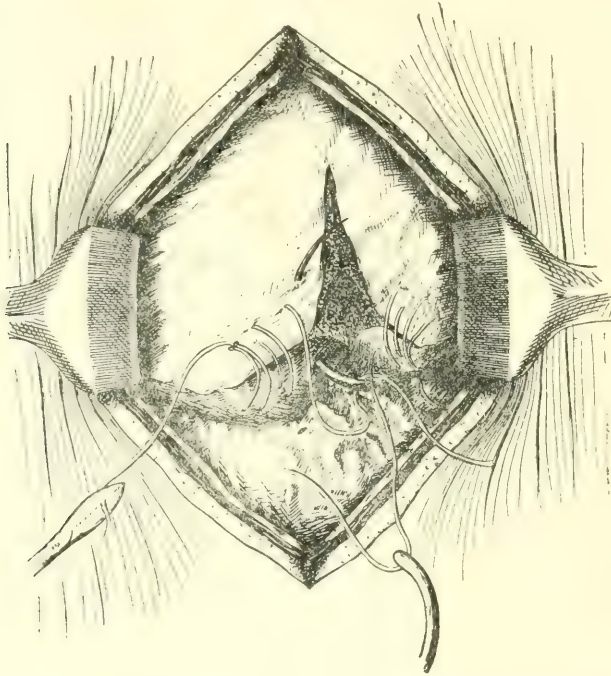
Method of closing raw spaces in the liver. The illustration shows a sharp needle; a blunt one is preferable. (Frank.)

In the discussion of this paper W. J. Mayo said that he had occasion to apply this method in two cases in which the liver was injured during removal of the gall-bladder. Hemorrhage stopped at once, and the operator was convinced that the method will be of great value in cases of excision of hepatic tissue.

MacLaren said that in a recent case he had found that three separate V-shaped resections for gummata of the liver could be nicely closed by over-and-over sutures.

Dudley Tait injects hot water into the liver along the line of proposed incision in order to lessen hemorrhage.

Cullen[1] was able to remove a large *carcinoma from the liver*, by the insertion of overlapping mattress sutures with blunt needles, before cutting into the liver. After the insertion of three or four sutures about 1 cm. from the line of section, the liver was severed for a corresponding distance, an assistant holding the placed sutures taut. The tumor was grasped firmly to prevent oozing. The sutures were then slowly and snugly tied. Others were introduced and the various steps repeated as above described. Five or six large vessels were encountered. These were readily picked up and ligated.

This tumor was secondary to a carcinoma of the left kidney. The kidney was extirpated eighteen months before any secondary growth was observed in the liver. Operation upon the liver was promptly performed, and as far as the examination made at the time was conclusive there was no other carcinomatous growth present. The patient recovered well from the effects of the operation. Cullen gives a brief analysis of the seventeen cases of resection of a part of the liver reported since 1899. Fifteen of these patients recovered. Other writers including in their lists of cases earlier operations have given the mortality between 15 and 20 per cent. Granting that these estimates are a little too rosy, it has at least been demonstrated that by proceeding carefully the operator can reduce to a minimum the risk of death from hemorrhage in operations upon the liver.

Use of Magnesium Plates in Resection of the Liver. Payr and Martina[2] recommend the use of thin strips of pure magnesium to control hemorrhage in resection of the liver. The strips are punctured for the passage of the blunt straight needles. One strip is placed along each edge of the future incision, both in front and behind. Catgut sutures are passed, but not tied until the resection is completed. These sutures are variously passed according to the nature of the case. When they are tied the magnesium strips make depression gutters on the surface of the liver, and as much greater tension can be employed than is the case without such strips. All bleeding is fully controlled. The strips are left in situ and the abdomen is closed. The blood and serum forthwith attack the metal, which unites with the oxygen to become magnesium oxide, and sets the hydrogen free. A gas containing fibrin is formed, which gradually becomes filled with granulations, and ultimately forms a firm scar. In numerous animal experiments there was no instance of uncontrolled bleeding, nor of secondary bleeding, nor of any untoward effect due to the magnesium.

Statistics of Operations for Hemorrhage from the Liver. Thöle[3] has collected reports of 399 laparotomies performed for hemorrhage from

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[1] Journal of the American Medical Association, 1905, vol. xliv. p. 1239.
[2] Verhand. d. deut. Gesell. f. Chir., 1905, ii. p. 549. [3] Ibid., i. 228.

an injured liver. The mortality was 40 per cent.; that is, about two fifths of the mortality which follows expectant treatment according to statistics of Mayer and Edler of 1872 and 1887, viz., 67 per cent. The mortality after various kinds of injury in spite of laparotomy is thus given by Thöle:

Stab wounds 22 per cent., gunshot wounds 49 per cent., ruptures 61 per cent. Death was due to hemorrhage in nine of the forty fatal stab wounds, and to peritonitis in eleven of them. In the sixty fatal gunshot wounds death was due to hemorrhage in twenty-three cases, and to peritonitis in twenty-four cases. Most of these last were due to accompanying perforation of stomach or intestines. There were fifty-nine fatal cases of rupture, death being due to hemorrhage in thirty-nine cases, and to peritonitis in eleven cases. The time of operation has naturally an influence on the result.

Thus the mortality after operation in the first six hours after injury was 33 per cent., from seven to twelve hours 48 per cent., from thirteen to twenty-four hours 45 per cent., and later than that 72 per cent.

Abscess of the Liver. For several years Cantlie has reported to the the annual meeting of the British Medical Association the cases of abscess of the liver he had met with during the year preceding. At the last meeting he reported[1] several such cases. Six were tropical abscesses, and the seventh developed in a man who had never been outside of England. In two of the tropical cases pus had penetrated the diaphragm and destroyed the lower lobe of the right lung. These patients died, as did one other in whom drainage was at first unsatisfactory. Five days later a better drainage was accomplished, but evidently too late, as at death on the following day a large part of the liver was found to be gangrenous. The other four patients recovered. In the six tropical cases the initial treatment was identical, viz., exploration with an aspirating needle, followed by the insertion of a large trocar and cannula, usually above or below the eighth rib, in the mid-axillary line, a rubber tube was then pressed through the cannula and the latter withdrawn. In the three fatal cases, as drainage proved insufficient to relieve symptoms, one or more ribs were resected, but the relief thus obtained was only temporary. In the non-tropical case pus was located by puncture, and then the abdomen was opened. The abscess was recognized by palpation, but as it was impossible to bring that part of the liver to the incision in the abdominal wall, the wound was sutured, and drainage was established through an intercostal space in the usual manner. This patient recovered after suppurative peri-

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[1] British Medical Journal, 1905, vol. ii. p. 1294.

hepatitis and infection of the wound in the abdominal wall. Pus from the liver contained streptococci of unknown origin.

Two years ago (PROGRESSIVE MEDICINE, June, 1904) I gave the methods of treatment employed by a number of surgeons who have had extensive experience with abscesses of the liver. The opinion of the majority was distinctly in favor of direct exposure of the liver, for the sake of thorough examination and drainage either through the abdominal wound or through a second wound made in the thoracic wall.

Tumors of the Liver. Thöle[1] has gathered together records of 167 operations for tumor of the liver, in 129 of which an exact diagnosis is stated.

In just half of these cases (65) the diagnosis of tumor of the liver was made before the abdomen was opened. In eighteen cases partial diagnosis was made, and in thirty-nine cases an incorrect diagnosis was made. The lesion in these cases was most often ascribed to the kidney, but also to the omentum, pylorus, colon, ovary, mesentery, pancreas, abdominal wall, uterus, and lymph glands. From these mistakes one can learn much. (1) In many cases (22) the presence of a tympanitic zone between the liver and the tumor led the observer to the conclusion that the tumor was not of the liver. In such cases the tumor was usually found to have a more or less developed pedicle. (2) In seven cases the observers, on account of the absence of hydrochloric acid in the gastric juice, made a diagnosis of carcinoma of the pylorus. The tumors were found to be, however, primary cancer in the liver, or gall-bladder, or to be syphilitic gummata. (3) In difficult cases tumors of the liver can be diagnosticated from those of the kidney only by ureteral catheterization and cryoscopy.

Only primary and solid tumors should be resected. They are rare, so that resection of the liver will always remain a rare operation no matter how much its technique may be improved. Cases suitable for resection are: 1, adenoma; 2, congenital carcinoma; (3) cystadenoma, if the bulk of the tumor causes serious symptoms; 4, syphiloma which is suppurating, or if non-suppurating, is not reduced by internal medication; 5, a movable lobe not controlled by bandaging; 6, the presence of an irreducible portion of the liver in a congenital hernia; 7, echinococcus in some cases; 8, solitary malignant tumor. Thöle advises that hemorrhage be controlled by mass and single ligatures, with temporary compression of the aorta if necessary. He rejects the elastic ligature and extraperitoneal treatment of the stump.

Hydatid Cysts of the Liver. Moore and Dunhill[2] report occurrence of an hydatid cyst in the small lobe of the liver in a patient whose organs, both thoracic and abdominal, were transposed. The abdomen was

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[1] Verhandl. deutsch. Gesell. f. Chir., 1905, i. p. 228.
[2] Intercolonial Medical Journal of Australasia, 1905, p. 24.

opened in the median line and the cyst punctured with a trocar and cannula. Before the latter was withdrawn, silk-tension sutures were inserted on either side of the puncture. The opening was then enlarged and the mother cyst removed. There were no daughter cysts. The cavity was dried with gauze and the edges of the incision accurately sutured with catgut. The spleen was felt in the right hypochondrium. The abdomen was closed without drainage. Recovery was uninterrupted.

Non-calculous Cholecystitis. While the literature upon gallstones and the treatment of the diseases due to them has been voluminous in the past few years, it is only recently that the possibility of non-calculous cystitis has received the attention that it deserves. By this is not meant suppuration of the gall-bladder, the so-called empyema, but an affection differing from the calculous cholecystitis in degree rather than in kind. This was the subject of a paper read by D. S. Fairchild[1] at the 1905 meeting of the American Medical Association. The symptoms of non-calculous cholecystitis closely resemble those of gallstone disease, but the classic gallstone colics are absent. Milder colics due supposedly to the passage of plugs of mucus do occur. In these cases exploration of the gall-bladder has been made, and when no stones have been found it has been supposed that they passed previously into the intestine. Drainage, however, relieves the symptoms just as surely as it does the symptoms of calculous cystitis.

Such a gall-bladder when exposed presents nearly the normal appearance, but on closer inspection, the walls appear to be a little thicker than normal, and the lymphatic glands along the common duct are frequently enlarged. The bile is dark, thick, and ropy, and the mucous membrane of the gall-bladder is covered with minute crystals of cholesterin. In some cases the mucous membrane is more or less actively inflamed or even ulcerated. In these cases the cholesterin crystals are less numerous. These same conditions may be found in the calculous bladder, but mark different stages and different degrees of development. In the non-calculous cases the milder or stone-forming period never existed. Experiments upon animals sustain this theory. The results of the severer inflammation are seen in the thickened bladder walls, the possibly ulcerated mucosa, the enlarged lymphatic glands, and possibly in a chronic interstitial pancreatitis due to the extension of the inflammation along the duct of Wirsung into the pancreas. Not infrequently the infection spreads in the liver and we have a more or less severe cholangitis. In other cases there is a pericholecystitis, as shown by adhesions particularly to the stomach.

[1] Journal of the American Medical Association, 1905, vol. xlv. p. 454.

In calculous cystitis there is often a sharp attack of colic with an equally quick subsidence, and a prompt recovery of all functions. In the non-calculous disease, there is a more protracted sense of stomach sickness and pain in the region of the gall-bladder. There may be slight colic due to the passage of plugs of mucus through the common duct, or slight jaundice due to the swelling of the mucous membrane. Besides these symptoms of a mechanical character, there are others due to the infection of the gall-bladder, bile ducts, liver, stomach or pancreas. Chills and fever are not infrequent. In the milder cases there may be no rise of temperature, and the diagnosis may be difficult.

The results of operation in the milder cases are quite as good as those for stone in the gall-bladder. A cholecystotomy with drainage for ten days results in a speedy cure. In severer cases the mortality of operation is higher and convalescence is protracted. In these cases cholecystectomy may be indicated. The following is a fair example of a case of medium severity:

A man aged twenty-six years had, four years previously, some attacks which had been diagnosed as gallstone colic, but for the past three years there were no distinctive attacks of pain, yet the stomach distress and nausea were more or less persistent, appetite uncertain and digestion much disordered. At times there was the faintest appearance of jaundice. Physical examination was negative and in the absence of evidence of disease of other organs it was determined that the gall-bladder was responsible for the ill health. When the organ was exposed there was little in its appearance to indicate disease. It was moderately filled with bile and no stones could be felt. Its walls were somewhat thickened; the glands along the course of the cystic and common ducts were enlarged and at first communicated the feeling of stones in these ducts. The head of the pancreas was enlarged and firm, giving rise at first to the idea of malignant disease. The pathological diagnosis was non-calculous cholecystitis with chronic pancreatitis from infection extending from the gall-bladder. A somewhat prolonged drainage of the gall-bladder resulted in a satisfactory recovery. Much anxiety was experienced for two weeks on account of a temperature from 101 to 103°, which varied from day to day according to the amount of bile drained. Never before the operation, while the patient was under Fairchild's care, had he found the temperature above 99.5°. He did not attribute the temperature following the operation to any condition of the wound itself, but rather to an infection of the liver.

Some may think that in this case a cholecystectomy should have been performed. The whole problem in the treatment of these cases consists in drainage and it may be assumed that as the gall-bladder is the chief centre of infection it should be removed. May it not be true, however,

that it is required to afford suitable drainage?   The surgeon must decide at operation if the common duct is equal to the demands for drainage to be made upon it.   If not, the gall-bladder should be left in situ.   It is certainly a less serious mistake to leave a gall-bladder that might better come out than to remove one that is much needed for drainage.

Gallstones in the Common Duct.   W. D. Haggard[1] says that the presence of a gallstone in the feces after an attack of colic, formerly gave rise to the hope that the trouble had reached a happy conclusion.   Such is rarely the case.   In the great majority of cases the colic fails to expel the stone.   When it is expelled there are almost always others left behind.   Thus in one of his cases there were ten stones found in the gall-bladder of a patient who had collected a number from the feces.   Another patient collected forty-five in this manner, and at subsequent operation, seven stones were found in the common duct.

The typical symptoms of gallstones in the common duct, enumerated in the order of their incidence, are: pain, chill, fever, sweating, hypersensitiveness, and jaundice.

Long ago Courvoisier pointed out that in 80 per cent. of the cases of obstruction of the common duct by stone there is contraction of the gall-bladder.   The chief reason for this is that at some time previous there has been infection of the gall-bladder which has thickened its walls, and perhaps, fixed it by adhesions due to a pericholecystitis.   Such a gall-bladder will not yield under pressure.   The liver ducts, however, yield, and the cells are sometimes so hindered in their secretion by the pressure that a grave cholangitis results.   This and infection render this complication of stone in the common duct most serious.

Obstruction of the common duct by stone is purely a mechanical condition and requires mechanical treatment, that is removal.   This gives opportunity for the relief of the other element, infection, by drainage, and drainage is the secret of success in the treatment of inflammations in the biliary tract.

In the discussion of this paper Porter and Grothan mentioned cases in which gallstones had been passed with feces, but no other stones were found in the gall-bladder at operation.

Ochsner said that acute obstruction of the common duct, due to the pressure of stone, should no longer be looked upon as an emergency.   There was a time when surgeons operated upon such persons at any hour of the day or night, and the mortality was very high.   Now we have learned that the condition can be changed from an acute into a chronic one.   If the stomach is washed out and food is withheld there is no occasion for anything to be passed from the gall-bladder through the common duct to the duodenum, as the parts are put at rest.   In many

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[1] Journal of the American Medical Association, 1905, vol. xlv. p. 452.

of these cases in which from one-quarter to two grains of morphine failed to control pain, the pain stopped within two hours after gastric lavage, and did not return so long as no food was given by mouth. It is well to prohibit, therefore, the use of food by mouth until the acute symptoms have completely subsided, and to operate before a recurrence of the attack.

W. J. Mayo said that as long as the disease is confined to the gall-bladder the operation is comparatively simple and will be followed by a very large percentage of permanent recoveries at a small risk; while when the stones have entered the common duct the whole liver ducts are exposed to infection, with possibilities of disastrous complications. The operation is then no longer simple, easy, and safe. The question for the patient to consider is whether he can afford not only to continue to suffer from the gallstones, but also to be exposed to serious danger of liver-duct infection, and to the more remote but still possible chance of carcinomatous degeneration. With regard to jaundice, the history will usually show that there was more or less jaundice at the time that the stone passed into the common duct, although stones may remain there for years without producing any jaundice at all. In other cases jaundice may become permanent from obstruction.

Haggard called attention to the fact that patients may mistake hardened lumps of feces for gallstones, especially after taking olive oil for a time. He therefore always insists on examining the stones himself.

Calculi in the Liver Itself. McArthur[1] presents the report of a case in support of the statement that gallstones do not always form in the gall-bladder, but may arise in great numbers in the hepatic ducts in the liver. His patient was a young man who had never had any serious illness, nor any cramps in his right side, until twenty-three days before operation. The attack was accompanied by a chill and fever, but no jaundice. These symptoms grew more severe and the gall-bladder was palpable. Later, jaundice became apparent, and the abdomen was opened. The gall-bladder contained mucus, but no stones. The common duct was wedged full of many large and small stones and contained stinking pus. As many as possible of these stones were scooped out and the common duct was drained. The patient died from septic cholangitis, without any peritonitis. The postmortem examination of the liver and biliary passages showed the existence of innumerable stones in the hepatic ducts, growing less as the ducts grew smaller. The smaller intrahepatic stones were all composed of bilirubin calcium.

In the discussion of this case Richardson, of Boston, said that one of

[1] Journal of the American Medical Association, 1905, vol. xlv. p. 1797.

the most important points in connection with the treatment of gall-stones is the impossibility of finding and removing those concealed in the hepatic duct. The surgeon, therefore, should not reproach himself if, after he has removed all that he can find, symptoms pointing to other stones continue. The complications in biliary disease greatly exceed those in disease of the appendix. We really know very little of gallstone disease, and for such knowledge we must depend largely on the surgeon's observation of pathological conditions during life. The symptoms caused by stones in various situations should be carefully noted when the situations of the stones have been determined. A practical point is this, that the incision must be large enough to admit the hand if the biliary passages are to be thoroughly examined.

Weir,[1] of New York, suggested the transverse division of the anterior and posterior sheaths of the rectus in order to gain more room than the vertical incision allows. The muscle itself can be hooked to one side and the sheaths sutured after the operation is finished.

Reference to intrahepatic gallstones was also made in PROGRESSIVE MEDICINE for December, 1905, p. 106.

Wandering Gallstones. Under this title Estes describes two cases in which the gallstones left the gall-bladder by perforation of its wall and lay in an abscess cavity outside of it. By the burrowing of the pus this abscess was shifted somewhat from its original position, and the stones travelled with it. In one case the abscess cavity was drained in the lumbar region, and as the sinus persisted somewhat more than a year later it was enlarged, and a stone as large as a pigeon's egg was found just above the cæcum. In the other case two large stones weighing together 65 grams (4 ounces) and a number of smaller ones were found in an abscess cavity to the right of the lumbar spine and to the left of the ascending colon. The sequence of pathological changes in these cases is probably as follows :

1. The development of the stones or stone in the gall-bladder. 2. An after-infection of the interior of the gall-bladder. 3. Suppuration and ulceration of the lining of the gall-bladder. 4. Coincident adhesions of the gall-bladder to the transverse colon, both omentums, and possibly to duodenum and mesocolon. 5. Perforation of the gall-bladder by extension of the ulceration; adhesions strong enough to resist the pressure of the escaping contents of the gall-bladder. 6. Encysting fibrous sac. 7. Gradual working downward of the abscess and contents.

Simple Stricture of the Common Bile Duct. Moynihan[2] had a patient in whom the above condition seemed to have been produced as follows: A stone became impacted in the common duct. Three months later

[1] Medical News, 1905, vol. lxxxvii. p. 1206.
[2] British Medical Journal, 1905, ii. p. 1390.

this stone was passed. As a result of the irritation set up by this stone an ulcer was formed, and this in healing gave rise to a stricture. The subsequent dilatation of the common duct above the stricture and of the hepatic duct was due to the obstruction, which was increased when stones again arrived in the duct from the gall-bladder. This condition is a rare one. Six previous cases have been reported. In two of them the stricture was excised and an end-to-end anastomosis performed. Moynihan performed a plastic operation and made a long longitudinal incision through the stricture and sutured this transversely. A gap was left in the centre of the suture line and through this he passed two rubber tubes, one upward and the other downward. Both were brought out through the wound. They were removed on the eleventh day. The patient made a complete recovery.

Valvular Closing of the Gall-bladder. A. E. Rockey[1] inverts a portion of the gall-bladder when closing it in order to prevent future leakage. This is accomplished by the insertion of two purse-string sutures, about one-half inch apart. The technique is similar to Kader's gastrostomy. A No. 14 E. catheter is used for drainage. If the gall-bladder is hard and contracted, or greatly thickened, this method is not feasible.

Suture of Common Bile Duct. W. J. Mayo[2] reports seven cases in which a portion of the common bile duct was lost, either intentionally in carcinoma or accidentally in difficult gallstone operations. In all of these restoration by suture was attempted three times with complete success. From this experience Mayo lays down the following rules for the performance of this delicate operation:

First. The common duct may be united end to end by through-and-through catgut sutures. It is essential that a few supporting sutures should be placed in the surrounding tissues, and that a portion of the circumference of the line of union be left open for relief of tension and drainage.

Second. The common and in certain cases the hepatic duct may be implanted into the duodenum, provided a peritoneal covered portion of the intestine be chosen for the purpose.

Third. To facilitate these operations the second portion of the duodenum should be loosened and drawn to the right and held by fixation sutures, preventing tension on the suture line of the duct.

Fourth. Drainage is necessary, should be pliable, covered with rubber tissue, and placed as distant to the suture line as will serve the purpose of protection against leakage.

As a duodenal implantation of the common duct is far more difficult than a cholecystenterostomy, Mayo preserves the gall-bladder for the

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[1] Medical Record, 1906, vol. lxviii. p. 901.
[2] Annals of Surgery, 1905, vol. xlii. p. 90.

latter operation, if its condition warrants it, in cases where the common duct must be sacrificed in part.

Crushing a Calculus in the Common Duct.   Ombrédanna,[1] of Paris, writes an article in favor of crushing a gallstone in the unopened common duct, to which he says the name choledocolithotripsy should be given, while the name choledocolithotrity should be reserved for crushing a calculus in the common duct through an incision in the duct.   The former is, of course, no new operation, having been performed intentionally as long ago as 1884 by Lawson Tait, and even before that by other operators, perhaps without any preoperative intent.   Of late years the operation has fallen into disuse, most surgeons having preferred to remove the calculus intact, after incision of the duct which contains it.

Ombrédanna has made a careful search through medical literature for records of cases which will throw light on the results of crushing operations, and has assembled fifty-three cases in which the statements are sufficiently definite to be of value.   Nearly one-half of these were performed by Mayo Robson.   The conclusions drawn from this study are fourfold:

1. The operation is very often possible.   It has, however, been attempted without success.   These failures may have been due to the composition of the calculi, though the records say little on this point, or to their size or their situation, etc.   Both large and small calculi have been crushed, and attempts at crushing have failed in cases in which the calculi were both large and small.   The writer concludes that there is a greater chance of success with small calculi, but that one cannot tell without trying whether a large calculus will crush easily or not. Most of the failures to crush a calculus have occurred when the calculus was situated in the portion of the common duct behind the duodenum or in the head of the pancreas.   This may have been due to the fact that an operator would naturally hesitate to use force as freely in these places as when the stone lies in the free portion of the common duct.   If more than one stone is present it is usually true that if one can be broken all can be; and yet there is one instance on record in which the operator was able to crush two stones but failed to crush the third. The crushing has been done sometimes with the fingers, sometimes with the jaws of a clamp covered with rubber tubing, and sometimes a needle has been thrust into the calculus and it has been broken up in that manner.

This acupuncture has been seldom employed, and is not without risk. Five cases are on record, with two successes, two functional failures, and one death.   It has not the same advantages as simple crushing, since the needle punctures through the wall of the common duct require

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[1] Rev. de Chir., 1905, p. 703.

drainage to avoid the risk of possibly septic bile. Moreover, the method lacks the advantages of a choledochotomy, and is indeed more dangerous in that it does not afford the free drainage of the passages which this operation brings.

Furthermore, a study of these cases shows that the fingers are better than any instrument for the purpose of crushing a calculus in the common duct. If the right hand is used, the thumb should be placed in the foramen of Winslow and the forefinger in front of the duct; and if the left hand is employed, the thumb should be in front and the forefinger in the foramen. The amount of force required to crush the stone is often insignificant. In some cases instruments have been employed successfully, but the records do not state whether fingers were first tried without success, and in one case at least a stone was crushed with fingers after an unsuccessful attempt had been made with instruments. Failure is, therefore, to be attributed to the composition of the calculus, rather than to its size or situation, or to the means employed to crush it; and since the surgeon can judge more accurately of the amount and direction of the force employed when the fingers alone are used, crushing instruments should be discarded. One instance is mentioned in which a calculus escaped under pressure, and could not again be found. A little forethought will prevent this accident. The second conclusion which can be drawn from the records is this, that a stone will either crush easily or not at all; so that if moderate pressure fails to crush it, an incision should at once be made for its removal.

2. The operation is not dangerous in itself. Choledocolithotripsy has a bad name. It is said to be dangerous in its performance and uncertain in its effects. Let us see on what this reputation rests. First, it is said that it may release harmful bacteria. Biliary calculi are known to contain bacteria, but in about one-third of the cases in the older calculi the germs are either dead or no longer virulent. Crushing of the calculus is said to lacerate the wall of the duct and so give rise to infected wounds. In two instances in which it was possible to inspect the parts soon after the crushing the walls were found intact. It is very unlikely that they will be lacerated if no instruments other than the fingers are employed. And should laceration occur, why should the probability of infection be greater than the probability of infection of the wound made in choledocotomy? This is drained, to be sure, through the abdomen, but the drainage through the common duct is sufficiently free as soon as a calculus has been crushed. Again, it has been said that to crush a calculus it must be accessible to the fingers. This is true, but it is equally true that in order to cut down upon a calculus it must be not only within reach, but within sight. Robson in one case attempted to expose the common duct in order to

cut down upon a calculus, but failing to do so he was able to crush it with
his fingers and cured the patient.   Turning to the results in operations
actually performed, and omitting the five cases of acupuncture already
mentioned, there remain fifty-three cases of successful or unsuccessful
attempts at crushing with four deaths.   The history of these fatal cases
follows: Langenbuch incised the gall-bladder, then excised it, and then
crushed a calculus in the common duct.   The patient died in twenty-
four hours.   The common duct was examined.   It showed no mark of
injury.   Robson incised the gall-bladder and crushed a calculus in the
common duct.   The patient died of peritonitis.   Careful examination
of the common duct failed to show any puncture of its walls.   Terrier
attempted to crush a calculus, but failing to do so incised the wall of
the common duct and removed it.   The patient who had a cirrhotic
liver died without trace of peritonitis or of biliary escape.   The wound
in the common duct had already healed.   Vautrin incised the gall-bladder
and the cystic duct in order to remove 105 calculi, and then crushed
one in the common duct.   The patient died in a week of septicæmia.   A
fair-minded person can hardly attribute the death in any of these cases
to the crushing of the calculus in the common duct, since in every case
this was the least severe of the operative work performed.   In eleven
cases in which choledocolithotripsy was the only operation performed
the patients all recovered.   The risk of the operation, therefore, must
be extremely slight.

3. The operation is advantageous.   It is well to retain the integrity
of the walls of the biliary passages.   Those who prefer choledocotomy
without suture say that drainage is desirable and that a second calcu-
lus coming down from the liver or gall-bladder and becoming obstructed
in the common duct will show its presence by the continued flow of
bile through the external fistula, and that the calculus may often be
extracted through this fistula.   As stated above, a biliary fistula gives
no better drainage than an unopened but unobstructed common duct.
The second point is true, but one should not, therefore, subject every
patient to an incision in the common duct.   If secondary obstruction is
going to take place, it means that another calculus exists higher up at
the time of operation, and also that it is of sufficient size to lodge in the
common duct.   Now such conditions are rare.   One should weigh the
possibility of them at the time of operation, and if it is likely that they
exist, the common duct may be drained.   If there is no evidence to that
effect, it is better not to open the duct unnecessarily.

4. The operation is usually efficacious.   Again, leaving out of consid-
eration the acupunctures, there are thirty-nine cases in which the opera-
tor succeeded in crushing the calculus.   In thirty-seven of these cases
there was a complete functional restoration.   In one case there was no

biliary flow re-established, and in the other it was restored for a few weeks, but in four months had again ceased. In this case operation showed a calculus at the origin of the common duct obstructing the passage. This was presumably a second hepatic calculus. Fragments of the crushed calculus begin to show in the feces in three days sometimes, but usually not for a week. They may not all be eliminated for a month. Their passage sometimes produces mild biliary colic.

Such then are the conditions and results of choledocolithotripsy. It preserves intact the walls of the biliary passages; it avoids a biliary fistula; it is quickly performed and reduces shock; it gives complete relief of biliary retention in most cases. On the other hand, if the calculus does not break easily, or if the operator feels it necessary to probe the biliary passages in order to convince himself that other calculi do not exist in the common duct; or if he considers there is risk of other calculi in the liver, the common duct should be opened. The crushing operation is not adapted to all cases of calculus in the common duct, but it should always be considered before the duct is opened.

THE SPLEEN.

Indications for Splenectomy. B. B. Davis[1] estimates the present mortality of splenectomy at 15 to 18 per cent. The reasons for and against the removal of this organ under various conditions are given by the author in the following summary:

1. Splenectomy is contraindicated in leukæmia, amyloid spleen, splenic hypertrophy secondary to cirrhosis of the liver, secondary malignant disease, and in the essential anæmias.

2. Splenectomy is usually preferable to splenopexy in wandering spleen, which is almost always due to previous hypertrophy.

3. In abscess of the spleen, if drainage can be successfully accomplished, it is preferable to splenectomy, especially if the splenic tissue is not destroyed.

4. In cysts, benign tumors, tuberculosis and sarcoma, splenectomy is the operation of choice, unless in the three former conditions resection of the lower extremity will remove all of the disease.

5. In rupture the organ should usually be removed. The operation should be done promptly, expeditiously, and with every expedient calculated to relieve and to prevent shock.

6. In the severe type of malarial spleen, with failure of medical means to relieve the malaria or the extreme splenic enlargement, splenectomy will often result in cure.

[1] Journal of the American Medical Association, 1905, vol. xlv. p. 698.

7. In splenic anæmia, if internal medication has proven futile, the only treatment that should be considered is splenectomy, which should be done at an early period as possible while the patient is able to withstand the operation and before incurable complications have arisen.

Cysts of the Spleen. W. A. Bryan[1] removed a cystic spleen weighing two and one-half pounds from a female patient aged thirty-nine. No cause could be assigned for the pathological condition. The patient made a prompt recovery. Bryan gives abstracts of numerous cases of splenic cysts, namely: 1 dermoid, 9 serous, 22 hæmatic, and 4 unclassified cysts.

The outcome of a cyst of the spleen depends on the nature of the cyst. Small, simple cysts cause no trouble. Blood cysts are prone to grow owing to the repeated hemorrhages occurring within them. Echinococcus cysts may rupture into a hollow viscus and escape to the outside of the body, producing cure, or into an internal cavity, producing death. When abscess formation follows a cyst the prognosis is that of the former. Complete cure sometimes occurs by absorption, shrivelling and calcification of the capsule. In echinococcus cysts this can only happen when the tænia is dead.

No splenic cyst should be punctured. If it is large enough to produce clear physical signs, it should be exposed by incision. Splenectomy should be performed whenever the spleen is so far destroyed that its usefulness is much impaired, provided that adhesions do not render the operation hazardous. If the substance of the spleen is well preserved, or extensive adhesions are present, the cyst should be incised and its cut edges stitched to the abdominal wound. Dissection of the cyst has been advised by some, but is a very dangerous operation on account of hemorrhage. In simple serous or hematic cysts, after the spleen is exposed and the diagnosis is certain, tapping is allowable. This treatment repeated once or twice may effect a cure.

C. P. Childe[2] reports an interesting case of splenic tumor diagnosed on account of its position in the lower abdomen as an ovarian cyst. The tumor was first noticed after an attack of sharp abdominal pain. It was, therefore, considered that its pedicle had become twisted and hemorrhage had taken place into the tumor. Through a median incision the blood cyst was exposed and emptied. Then it was discovered that the solid portion of the tumor was a wandering spleen adherent in the pelvis, its pedicle being twisted. The pedicle was tied in sections on account of its great breadth, and the spleen freed from adhesions and removed. It weighed eight ounces (after emptying the blood cyst). The patient regained perfect health. Splenopexy was

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[1] Journal of the American Medical Association, 1905, vol. xlv. p. 680.

[2] British Medical Journal, 1905, ii. p. 1631.

contraindicated in this case on account of the blood cyst, and also on account of alarming hemorrhage which followed attempts at separation of adhesions, made before by ligating the pedicle.

Splenectomy for Volvulus. G. A. Syme[1] reports the removal of a spleen for twisting of the pedicle and thrombosis of its vessels. This occurred in a woman, aged thirty-seven, and was the fourth attack. Because of the scanty urine in these attacks, and also because the right kidney was movable, the tumor on the left side was thought to be a displaced kidney. Recovery followed the splenectomy.

Splenectomy for Myelogenous Leukæmia. Richardson[2] reported four years ago the successful removal of a spleen weighing 2275 grams (nearly 5 pounds) from a patient with advanced leukæmia. There was for a time marked improvement in the patient's general health, but later her condition became very bad, and she died from locomotor ataxia four years after the removal of the spleen. Richardson thinks neither the early improvement nor the later distressing symptoms can be attributed to the operation. He published the final details of the case in order to correct any impressions which its earlier publication may have caused, *i. e.*, that splenectomy is justifiable in myelogenous leukæmia. He now holds strongly to the opinion that operation is contraindicated in such cases, in which he agrees with Davis (*vide supra*).

THE PANCREAS.

Surgery of the Pancreas. Villar, of Bordeaux, presented a report upon the "Surgery of the Pancreas" to the French Congress of Surgery held in Paris last October.[3] He pointed out successively the functional signs of diseases of the pancreas, a gland with external secretions (sialorrhœa, diarrhœa, stearrhœa, etc.) and internal secretion (glycosuria). Diagnosis is furthered by observance of disturbances of adjacent organs, as well as by inspection, palpation, and especially percussion of the pancreas itself. It is true that diagnosis is often impossible and always difficult; but the surgeon has to guide him already a considerable mass of published facts both clinical and experimental. In making an abdominal diagnosis one should always bear in mind the possibility of pancreatic disease.

The affections of the pancreas which may require surgical treatment are as follows: Annular pancreas, hernia and spontaneous displacements, traumatisms (contusions, wounds, hæmatomata, pseudo-cysts,

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[1] Intercolonial Medical Journal of Australasia, 1905, p. 319.
[2] Annals of Surgery, 1905, vol. xlii. p. 656.
[3] Rev. de Chir., 1905, p. 636.

traumatic herniæ), acute infections (simple, hemorrhagic, suppurative or gangrenous pancreatitis), chronic pancreatitis, tuberculosis, calculi, solid and fluid tumors, and fistulæ.

Treatment was considered by Villars under three heads: (a) the technique of and general indications for operation upon the pancreas; (b) medical treatment and organotherapy; (c) the surgical treatment applicable to the individual lesions of the pancreas, with the immediate and late results of the same.

For annular pancreas he recommends gastroenterostomy; for displacements, pancreatopexy. After traumatism one should intervene promptly, suture the gland whenever there is hope of saving it in this manner, resecting a portion if compelled to do so, but never removing the whole organ. For traumatic cysts he prefers cystostomy complete in one operation. In acute, simple pancreatitis it is advisable to drain the region of the pancreas and also the gall-bladder. Drainage is also indicated in hemorrhagic pancreatitis, while if the hemorrhage is outside of the pancreas (hæmatoma) the pouch which contains the blood should be fixed in the abdominal wound if possible (marsupialization). If an abscess exists, its contents are to be evacuated by puncture and aspiration, then a free incision is to be made and the walls of the cavity attached to the edges of the abdominal wound if possible. Treatment is the same in cases of necrosis of the pancreas. Villar reviewed the various procedures which have been proposed for the treatment of chronic pancreatitis, concluding that the simplest and best is the drainage of the biliary tract combined with cholecystectomy. If a pancreatic calculus exists without complications it should be removed (pancreaticotomy), to which in some cases a pancreatogastrostomy should be added. A cyst of the pancreas should be punctured and emptied, and the sac removed; or if this is not possible, the cyst should be stitched in the abdominal wall at once (marsupialization). Solid tumors situated in the tail or in the body of the gland may be excised. This is sometimes true of those situated in the head, but total pancreatectomy of the head is unwise, and removal of the whole pancreas should never be performed. Therefore, if an extensive tumor of the head or of the whole gland exists some palliative operation should be performed, such as cholecystenterostomy or cholecystogastrostomy.

The best method of approach to the pancreas is through a vertical median or (for the head) a right lateral incision. When the abdomen has been opened there are three routes possible: the gastrohepatic, the transmesocolic, and the gastrocolic. The last is the simplest and most direct, and it is the route of choice. If it is chosen, the gastrocolic omentum is incised, the stomach is drawn upward and the colon

downward, the posterior peritoneum is incised, and the pancreas is exposed. In rare cases one is called to expose the pancreas through the transpleural or the lumbar route.

Garrè has observed one case of *pancreatic cyst* the result of severe traumatism. Two other cases of cyst of spontaneous occurrence were associated with violent pain in the form of crises. Laparotomy in these two cases revealed necrotic areas in the pancreas as large as a nut or even a pullet's egg, consecutive to embolism. The resulting cysts in such cases are therefore pseudo-cysts and not true glandular cysts. Their origin is necrobiotic.

Garrè gave three rules for the treatment of *acute pancreatitis*: 1. A prompt operation within forty-eight hours of the attack. 2. A quick operation to reduce the shock. 3. Isolation of the infectious focus during the operation. He divides the gastrohepatic ligament and makes a perfect toilet of the lesser peritoneal cavity. He has operated in eleven of these cases with seven recoveries.

Doyen said that the diagnosis of *pancreatic cysts* is often a difficult one even at operation, so that probably many of the cysts that have been reported as pancreatic cysts have only been cysts of the region of the pancreas and have had nothing to do with the gland itself. He makes a practice in operating upon cysts of the upper abdomen to turn the patient on the side, so that the contents of the cyst may more readily escape without soiling the peritoneal cavity. Complete extirpation of the cyst is generally impossible, for the reason that the cyst has no true wall, but is limited by the neighboring organs. The best treatment is, then, the resection of the portion of the wall that is available, and marsupialization of the rest of its cavity. This is dressed with aseptic tampons and drained. There then remains the treatment of the resulting fistula. If the fistula is a simple one, it will usually close, especially if aided by cauterizations with iodine or silver nitrate. If it is lined with mucous membrane, such slight measures do not suffice. In one case Doyen dissected the fistulous tract up to its connection with the pancreas. By a procedure similar to the implantation of a divided ureter in the bladder he then tied in the end of the fistula a little tube, and introduced this and the end of the fistula into the stomach through a short incision in this organ, along the greater curvature. The anastomosis was fixed by two longitudinal folds of gastric serosa and a double row of sutures.

Thiéry advocated cholecystostomy instead of cholecystenterostomy for *cancer of the pancreas*, as the former operation is simpler and less dangerous and gives, according to his observation, equally good results. In cases of retention the prolonged bilious fistula seems to have no bad effect on the patient.

Cramwell, of Buenos Ayres, spoke of the rarity of *hydatid cysts of the pancreas*, of which he had seen only one in a series of 1700 cases of hydatids of various parts of the body. This cyst was in a child of fourteen years, who presented symptoms of chronic icterus and a deep-seated tumor in the epigastric region. At operation the gall-bladder was much dilated, and there was a tumor the size of the fetal head in the inferior portion of the head of the pancreas. The lining membrane was extracted and the pericystic pouch was sutured without drainage. The operation was followed by fever, tympany, and vomiting, but these symptoms disappeared with the discharge of a collection of infectious material, and the child made a perfect recovery.

Lejars also reported an operation for hydatid cyst of the pancreas. His patient was a woman, aged fifty-five years, whose trouble was long standing. The cyst was suppurating at the time of operation. Her condition was cachectic. The cyst was found at operation to be of the body of the pancreas, and to be very adherent. Attempts to remove it resulted in severe hemorrhage. Its contents, consisting of daughter cysts and pus, were evacuated. The patient died in eight days.

Mayer, of Brussels, gave the results of a series of experiments performed upon dogs in order to study the effect of *ligature of the pancreatic ducts*, and of partial and total resections of the gland. In some of his cases operation produced fatty necrosis of the pancreas and death of the animal within forty-eight hours. According to his belief fatty necrosis is due to the escape of pancreatic fluid into the peritoneal cavity. A few drops suffice for the purpose. These experiments show the following practical points: 1. There is no great danger in the ligation of the excretory ducts of the pancreas. 2. The greatest care should be employed to prevent the escape of any pancreatic fluid into the peritoneal cavity. 3. If a part of the pancreas is resected, the stump should be closed in as well as possible and be further protected by covering it with omentum. 4. The peritoneal septicæmia so often observed in operations upon the pancreas probably has its origin in previous fatty necrosis which has been overlooked.

Vidal, of Arras, said that in his experiments he had never succeeded in keeping a dog alive after removal of the whole pancreas. He has found that the secret of successful operations upon the pancreas, at least in the dog, is to observe the most perfect asepsis.

Rupture of the Pancreas. C. Garrè[1] reports an instance of this rarely reported lesion. A twenty-four-year-old man was caught between car buffers. There was abdominal pain, but no vomiting until three hours later, when vomiting produced intense abdominal pain not controlled

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[1] Beit. z. klin. Chir., 1905, vol. xlvi. p. 233.

by about a grain of morphine. Rigidity of the abdominal muscles,
noticed before, was much increased. The abdomen was opened four
and one-half hours after the trauma. It contained much blood, which
reappeared after it was removed. A prolonged search revealed its
origin, behind the stomach. The lesser omentum was torn through,
and the pancreas exposed. It was completely divided about 10 cm.
(4 inches) from the tip of its tail. The halves were united by posterior
and anterior silk sutures, and the abdomen was closed with drainage.
The discharge of pancreatic fluid eroded the wound, but the sinus
closed in five weeks and the patient recovered.

Garrè has found mention in literature of eight other cases in which
rupture of the pancreas was the chief or only serious injury. In all
of these the force was of such a character as to crush the pancreas
against the spine. One patient was caught between buffers; two were
run over; two were struck in the abdomen with a hard, small object
like a wagon-pole, etc. In no case was a correct diagnosis made
before the abdomen was opened. In two cases operation was per-
formed, but death followed from peritonitis. In a third case, three
weeks after the injury, the abdomen was incised and 2.5 litres
(2½ quarts) of blood were removed. This patient lived five months.
Garrè advocates an exact suture of the pancreas rather than mass
ligation of its bleeding substance in order to lessen the risk of fatty
necrosis of damaged tissue. But as this cannot probably be wholly
prevented, drainage of the peritoneal cavity is imperative.

GYNECOLOGY.

By JOHN G. CLARK, M.D.

Carcinoma of the Uterus. THE ETIOLOGY OF CARCINOMA has been very much discussed during the past year. The chief outcome of this discussion has been to emphasize the fact that the cause of carcinoma is still unknown, and to prove that no theory has been substantiated. Thus the general results of the statistics of the Imperial Cancer Research of Great Britain may be summed up in the statement that the lethal activity of carcinoma centres around the inherent vital power of epithelium for continuous proliferation. Whether the genesis of this growth or the toxic principle of the cancer cells is analyzable is yet to be determined. Certainly we are still as completely in the dark as we were many years ago.

Pick[1] questions whether, with our present knowledge of the *biology of cells*, and our available means of investigation, it is possible to solve the carcinoma question. We cannot, he says, define the real essence of malignancy in cells, for the physiology of normal cellular activity is not understood. According to his conception the malignant activity of cells will ultimately be explained upon biologic grounds. Israel also believes in this explanation of cancer, and repeats his views, which were extensively reviewed in PROGRESSIVE MEDICINE in 1903. v. Bergmann[2] favors the biologic theory and inclines to the view which holds cancer as the product of chronic continuous irritation.

Hawkins, in 1885, observed the development of cancer in the scars produced by the inhuman flogging of British Sailors. Some of these people showed a network of scars as thick as one's finger, from which carcinoma occasionally developed. One of the largest cancers v. Bergmann ever saw occurred in the scar of a very extensive burn. He mentions Paget's disease, the eczema of paraffin workers, psoriasis of the tongue and cheeks, lupus, xeroderma pigmentosum, and nævi. He denies the possibility of a primary carcinoma of the extremities without some preceding disturbance of the skin, such as cicatrices, fistulous passages, ulcerations, eczema, seborrhœa, warts, or moles.

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[1] Berichte der Berliner medizinische Gesellschaft. Berlin. klin. Wochenschr., xlii., Nr. 13.

[2] Ueber Krankheiten die dem Krebs Vorangehen. Berlin. klin. Wochenschr, xlii., Nr. 30.

Perhaps the most prominent adherent of the *parasitic theory* is v. Leyden,[1] who is inclined to accept this view even though it has not been proved. He believes the clinical picture which carcinoma presents is that of a parasitic disease—the patient, previously healthy, is suddenly stricken with the new-growth, which stamps him with pallor and emaciation, and increases continuously until it ends his life. In comparing the effects of new-growths he refers to the woman with a fibroid tumor and to the one with cancer. The first is healthy, active, and strong until mechanical effects are produced; the other, even with the smallest cancer, quickly becomes wretched and pale; cachexia supervenes, and she perishes within a measurable time. The traumatic theory of v. Hansemann, he says, is only in the line of the parasitic theory, for trauma always opens the path for bacterial invasion. So in carcinoma, an injury furnishes an implantation basis for cancer parasites. He believes the location of primary carcinoma, so frequently upon areas exposed to infection—the face, lips, tongue, throat, larynx, lungs, stomach, intestines, and genital organs—and the comparative infrequency of it in visceral organs difficult of access speak for its parasitic origin. In recent years carcinoma has been discovered in amphibia and in mammalia. Such domestic animals as rats, cats, dogs, horses, etc., which are found especially in the neighborhood of hospitals and pathological institutes, are more prone to this disease than wild animals like the deer, in which no certain case has as yet been reported. Relative to the geographical distribution of carcinoma, it occurs very rarely in the far North or at the Equator, while in the temperate zones where the population is thickest it is most frequent. The significance of this is illustrated by the negro race. Reliable English physicians have rarely found the native African affected by carcinoma, while in America carcinoma is as frequent in the black as in the white race. From such facts some adherents of the parasitic theory claim that association with other people favors the spread of carcinoma. The occurrence of cancer à deux, the inoculation of one mouse from another, the growth of cancer cells transplanted in man from the original seat of the disease to another part of the body, and the occurrence of inoculation metastases, observed in surgery, according to v. Leyden, are all arguments in favor of the parasitic theory. Finally, he is not convinced that the peculiar bodies found in cancer cells are simple products of degeneration or mere cell inclusions.

Noteworthy experiments have been made by Robertson and Wade[2] to

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[1] Ueber die parasitäre Theorie in der Aetiologie der Krebse. Berlin. klin. Wochenschr., xlii., Nr. 13.

[2] Researches into the Etiology of Carcinoma; on the Presence of Plasmodiophorae in Carcinomatous Tumors and the Successful Culture of the Parasites. Lancet, January 28, 1905, p. 215.

determine the validity of the claim that the parasite of cancer is of the same class as the *plasmodiophora brassicae*, which is known to cause tumor growths in cruciferæ as well as in other plants. This hypothesis was mentioned by Plimmer, whose paper I reviewed last year, and has also been advocated by Behla, Podwyssozki, Park, and Gaylord. The plasmodiophora brassicæ is the organism which produces the tumors found at the root of the turnip, referred to in this country as "finger-and-toe disease," and in Germany as "Kohlhernie." From the description of this organism, as given by Naivaschin, De Barry, Gaylord and others, it is evident that the observers are unable, owing to difficulties in staining, to trace the evolutionary stages of the organism. Robertson and Wade used a special method of staining (ammonio-silver processes and toning with gold or platinum), by which they secured uniform and accurate results. They found great histological similarity between:

1. The life cycle of the plasmodiophora brassicæ:

2. A series of bodies found especially within the cells of carcinomatous tumors.

3. The stages of an organism which can be grown from such tumors.

The last line is incomplete, but in eight out of fourteen phases or four out of seven separate stages the parallelism is exact. The authors say they have constantly kept in mind possible fallacies in such an investigation, and while they admit that the bodies found in carcinoma cells, which they have taken for various cycles in the life of the plasmodiophora brassicæ, have not been demonstrated absolutely, yet the same bodies are found in cultures from carcinoma in at least most of the forms of evolution of the organism. This evidence, they believe, is incompatible with any other conclusion than that these organisms are plasmodiophoræ.

In commenting upon the papers of Robertson and Wade the editor of the *Journal of the American Medical Association* believes they are straining a point, doubtless unconsciously, to make the description of the so-called parasite tally with that of the known organism which it is supposed to resemble. The description of the culture experiments shows certain noteworthy peculiarities in the supposed organism—such as its absolute failure to grow in the presence of the small amount of condensation water usually present in agar tubes, its absence from smear preparations, and its presence only in hardened sections of the agar—all of which suggests the possibility that the bodies described were merely artefacts.

In strong opposition to the opinion of Robertson and Wade, Greenough[1] reaches the following conclusions: 1. The typical cell inclusions are practically constant in cancer of glandular origin. 2. They

[1] On the Nature of the Cell Inclusions of Cancer. The Journal of Medical Research, vol. xiii., No. 2, p. 137.

are not found in epithelioma and are almost invariably absent in sarcoma. 3. Their size, structure, and staining reactions are such as to justify the assumption that they are vacuoles in the cell protoplasm, containing a material which is coagulated and shrunken by the use of the hardening fluid. 4. The occurrence of vacuoles of this nature is chiefly a phenomenon of cell secretion. 5. Similar vacuoles may be produced, however, in certain cases of phagocytosis and by degeneration of the nucleus. 6. Secretion vacuoles of the form of typical cancer cell inclusions are found in certain non-cancerous diseases of the mammary gland. 7. In such cases secretion vacuole occupies a position between the nucleus and the lumen of the gland. 8. The inclusions in adenocarcinoma occupy a similar position between the nucleus and the lumen of the gland. 9. In more advanced carcinoma the gland lumen is lost; the secretion vacuole cannot escape and remains within the cancer cell to undergo further increase and ultimate degeneration. 10. Cell secretion is a function which is lost in the progressive anaplasia of cancer cells. 11. Cell inclusions are more frequent in slow growing cancer, and are less numerous in advanced cancer with rapid cell division. 12. No reason exists for the interpretation of these appearances as of parasitic origin.

Aside from the morphology of the organism itself what evidence is there to indicate that carcinoma is an *infectious disease*? The infrequency of multiple primary mixed growths (*i. e.,*tumors containing both carcinoma and sarcoma elements) speaks for the specific nature apparently of each. Grawitz considers that the infrequency of multiplicity speaks against the theory of its infectious nature, but the editor of the *Journal of the American Medical Association* does not agree with him, for "how often," he asks, "do we have primary simultaneous infections of different organs by pathogenic bacteria?" The same writer subsequently notes an apparent exception to the specific nature of carcinoma, when he relates that in the mouse experiments of Ehrlich and Apolant a carcinoma which had been transplanted from one mouse to another suddenly at the tenth generation became partly and finally fully sarcomatous. This tends more, we think, to the biologic theory, and the explanation is given that because of the successive transplantations the connective tissue in the original cancer took on an increased power of growth that surpassed the normal and became malignant.

Why, asks Israel,[1] if there is anything in the parasitic theory of carcinoma, does not coccidial disease of the liver of rodent animals result in carcinoma? When the parasite in this disease finds entrance to the epithelial cell there is no proliferation of the cell; instead the cell perishes. There is, however, a proliferation of the unaffected cells to replace those

[1] Die biogenetische Theorie der Geschwülste und die Aetiologie des Carcinoms. Berlin. klin. Wochenschr., xlii., Nr. 13.

lost and a benign fibroepithelial cystic tumor is formed. But it is not produced by the stimulation of the epithelial cells to multiplication in the same sense that the spermatozoon produces active division in the ovum. It is a proliferation of the connective tissue to keep pace with the increased epithelial surface caused by the collection of coccidia and the epithelium formed to replace the cells killed by the parasites.

In line with Israel's observation on the influence of the spermatic particle upon the division of the ovum, Farmer, Moore, and Walker[1] have found in the spermatic particle on the mouse and of man certain constituents which closely resemble "Plimmer's bodies." Beatson,[2] who mentions their paper, is inclined to believe in a germinal (reproductive tissue) theory of cancer.

Pick has found a case of malignant teratoma of the liver—a case of epithelioma chorioectodermale—of which certain parts would have been taken for an ordinary carcinoma. This certainly could not have been due to a parasite. In a lymph gland containing a metastatic growth from a malignant teratoma of the testicle he discovered an actual embryonal hollow bone with its marrow. Can this be explained upon the parasitic theory?

The *inoculation experiments* which have been undertaken to determine the infectious nature of carcinoma have certainly failed to show any infectious properties in carcinoma. It has long been known that transplanted tissues will grow, but, as pointed out by Orth and noted in my review of last year, the growth occurs only in the transplanted cells and not in the surrounding tissues. Nichols[3] quite recently has found that:

1. Certain types of epithelium (epidermis), both adult and fetal, can be experimentally removed from their normal position and implanted into another part of the same animal, and under those circumstances can maintain their "potentiality of growth," retain their own peculiar character, and produce nodules analogous to dermoid cysts or more complicated teratoma.

2. In no case has any epithelium of a highly differentiated function been seen to maintain its power of growth or to proliferate.

3. The "potentiality of growth" is greater in the case of fetal than of adult tissue.

4. In no case has any infiltration of surrounding tissue by the transplanted epithelium been seen, nor any tendency to epithelial metastasis.

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[1] On the Resemblance existing between the Plimmer's Bodies of Malignant Growths and Certain Normal Constituents of Reproductive Cells of Animals. Lancet, May 27, 1905, p. 1411.

[2] Remarks on the Etiology of Carcinoma. Has it a Physiological Function in the Body? British Medical Journal, April 29, 1905, p. 21.

[3] Implantation of Tissue and its Relation to Cancer. The Journal of Medical Research, January, 1905, vol. xiii., No. 2, p. 187.

5. Certain fetal connective tissues (cartilage) can be transplanted in the same way as epithelial tissues, and retain their "potentiality of growth."

6. Transplanted fetal tissues do not reproduce the stage of development at which they are transplanted, but tend to reproduce the ultimate stage of their normal development.

If carcinoma were really infectious, says Krönig,[1] why has no case of infection of the surgeon or of the nurse from a cancer patient been recorded? This is a striking query. The accurate observations of Milner[2] upon this question are also of importance. He says that the unintentional transplantation of carcinoma to another individual of the same species has not yet been observed.

We must, therefore, conclude with v. Hansemann,[3] that inoculation experiments in cancer will prove nothing unless the cancer can be produced by inoculation of its juices and not of the cells themselves. In this he agrees with Orth,[4] who draws attention to the fact that real infections produce a multiplication of the cells of the infected part. In the transplantation experiments with carcinoma, however, it is the transplanted cells which proliferate and not those of the organ into which the transplantation is made. v. Hansemann[5] believes the so-called *cancer epidemics* are the result of chance; they are so frequent that it appears justifiable to so explain them. He also believes that there may be many causes of cancer active in different varieties, as for instance in the following: round-cell sarcoma of the testicle following a blow, malignant teratoma of the ovary, indolent epithelioma of the face in old people.

From this review we can, without hesitation, render the verdict of "not proven" concerning the parasite as a provocative cause of cancer.

PATHOLOGY. The pathological anatomy of the parametrium and of the pelvic lymph glands in carcinoma has been widely studied. The observations of Kundradt, which were reviewed in PROGRESSIVE MEDICINE two years ago, showed the very important fact, which is now quite generally accepted, that in only 40 per cent. of the cases of cancer as they present themselves is the disease confined strictly to the uterus. So that at the present time nearly everyone is agreed that a wide extirpation of the parametrium is imperative. The question of glandular involvement in carcinoma is yet a moot point.

[1] Das Carcinom. Eine klinische Studie auf grund eigener Beobachitung. Deutsche med. Wochenschr., xxxi., Nr. 19.

[2] Giebt es "impf-carcinomia." Archiv f. klin. Chirurg. (Langenbeck's), Bd. lxxiv., Nrn. 31 u 45, S. 668 u. 1009.

[3] Was wissen Wir über die Ursache der bösartigen Geschwülste. Berlin. klin. Wochenschr., xlii., Nrn. 12 u. 13.

[4] Die Morphologie der Krebse und die parasitäre Theorie. Berlin. klin. Wochenschr., xlii., Nr. 12.

[5] Berlin Letter; Journal of the American Medical Association, vol. xliv., No. 15.

Baisch,[1] who has recently investigated this part of the carcinoma problem, asks whether there is a definite line of invasion of the glands, and whether it bears any relation to the implication of the parametrium in the process. From Wertheim's cases (Kundradt) one would be led to think that there was no such constant relation and that the involvement or not of the glands was to a certain degree a matter of chance. From Kundradt's observations, which have been recently referred to by Wertheim, the glands were carcinomatous in 10 per cent. of cases in which the parametrium was free of cancer, and in 27.5 per cent. of cases in which the parametrium was diseased the glands were free. From Schauta's paper, which we reviewed last year, the involvement of the individual groups of glands bears no constant relation to other groups. Thus, according to him, glands at a more remote point from the cervix may be infected while those nearer are free. Baisch, who has recently studied this question, first takes up the *anatomy of the pelvic lymphatics.* He says that from five to eight lymph channels run from the portio and cervix laterally along the uterine artery. They are divided into three sets which empty into the lymphatic glands in three different areas. The first set empties into the iliac glands upon the anterior surface and inner border of the external iliac in the vascular triangle between this and the hypogastric (anterior branch of the internal iliac artery) artery; the second division courses more posteriorly and empties into the hypogastric glands on the inner border of the hypogastric vessels. Each group comprises three to five glands; the lowest of the iliac glands are known as the obturator glands. The third division of the lymph channels, which springs more from the dorsal side of the cervix, runs over the posterior vaginal fornix through the uterosacral ligaments to the posterior pelvic wall and empties into the glands lying alongside the sacral ganglia or higher up and more in the median line beneath the promontory. There are also small lymph glands or nodes in the parametrium. The first of these is found at the point where the uterine artery crosses the ureter; others are found in an annular position surrounding the lymph channels.

The lymph channels of the corpus uteri leave the uterus in four or five chief branches, through the broad ligament and directly beneath the tube and above the ovary, from which they receive tributaries, and thence in company with the surrounding ovarian vessels, they pass upward and end above the division of the aorta into the right and left lumbar glands. Besides these main branches from the corpus there are some lymphatic radicals which arise about the middle of the uterus. They have an origin partly in common with the cervical lymphatics and finally pass along the round ligaments and empty into the superficial and the deep inguinal

[1] Der Werth der Drüsenausraümung bei der Operation des Uteruscarcinoms. Archiv f. Gynäk., lxxv. H. 2, S. 273.

glands. The regional glands of the uterus, therefore, are: 1, parametrial; 2, iliac; 3, hypogastric; 4, sacral; 5, lumbar; 6, inguinal.

In *carcinoma of the cervix*, therefore, the first four of these sets of glands are most directly in communication with the cervix and are, therefore, the most likely seats of metastasis. They may be spoken of as the lower or the first group. The lumbar and the inguinal being more remote represent the second group. In *fundal carcinoma* the lumbar and the inguinal glands are the nearest sites of possible metastasis, while the more remote ones comprise the glands lying above the renal vessels along the aorta as far as the diaphragm. From a study of ninety cases Baisch reaches the conclusion of other observers (Kundradt, Laméris-Kermauner) that in early cases of carcinoma with no infection of the parametrium the glands are seldom diseased (5, 12.5, and 16 per cent.), whereas with involvement of the parametrium the glands are infected in about half of the cases (40 to 50 per cent.).

Schauta's observations (see last year's PROGRESSIVE MEDICINE) would seem to positively indicate that as a rule there is no definite plan of involvement. Thus, according to him, in a study of sixty cases in 8.3 per cent. the inoperable and second group of glands are affected while the lower series of glands are free; in 43.3 per cent. of all cases no glands are at all involved, and in 35 per cent. where the lower accessible glands were involved the upper inaccessible glands were also affected. This would leave but 13.3 per cent. of all the cases, therefore, in which there would be any sense in attempting glandular extirpation.

Baisch points out the defects in Schauta's deductions. First of all fifty of his cases were inoperable and had died of carcinoma. These should be ruled out because in the discussion of cervical carcinoma from an operative standpoint operable cases only come into serious consideration. Among the ten operable cases which Schauta had, in eight the glands of the pelvis were not carcinomatous while in two cases both the upper and the lower groups were involved. Schauta's opinion, therefore, that carcinoma may affect the higher glands without involving the lower ones finds no confirmation in his operable cases, and his chief argument, that when the lower glands are involved the upper are also, depends upon two cases, a very small number. Furthermore, the glands of the second group, lumbar and inguinal, which Schauta styles inoperable, are removed by Mackenrodt, Amann, Krönig, and Döderlein, so that the inoperable glands are only those of the celiac and diaphragmatic groups. The author further points out that Schauta does not state whether cases of carcinoma of the corpus are included in his statistics or not. From an examination of the cases given by Schauta as examples of involvement of the upper group of glands, with no involvement of the lower ones, it would appear that the cases were corporeal cancers, the glands involved being either

the lumbar or the inguinal and never the parametrial, iliac, hypogastric, or sacral. From the results of Winter's examination in forty-five cases and of Oehlecker's in seven cases involvement of the lower glands only was found in cervical carcinoma. In fifty-three cases of cervical carcinoma examined by Baisch, partly autopsy cases (17), partly attempted but unfinished radical operations (8), and partly completed radical operations (28), the author found a definite order of involvement of the glands. Thus in the twenty-eight cases of cancer of the cervix which were removed radically there were forty-five carcinomatous glands:

Parametrial	11
Hypogastric and iliac	26
Sacral	2
Lumbar	4
Inguinal (deep)	2

In twenty-six of these cases the first group only was involved; in two both groups were involved; but in no case was the second group involved when the first group was free. From this it would appear, says Baisch, that metastases to the glands in cervical carcinoma follow the physiological and anatomical lymphatic distribution; that this involvement has a regular course and that there is no break in the chain. From Oehlecker and Vinay's cases it is to be noted that occasionally when the glands of the first group are affected the glands of the second group will appear enlarged as the result of inflammatory hyperplasia, even though they are not diseased. Brunet[1] has recently reported the findings in an examination of forty-seven sets of lymphatic glands removed by Mackenrodt during operation. In 51 per cent. of these cases one or several of the glands were carcinomatous. This is a higher percentage than that given by Baisch. No glandular enlargement was found in Brunet's series of four cases of carcinoma in which the carcinoma was confined to the vaginal surface of one lip of the cervix. In seven cases of carcinoma involving both lips or one lip and a part of the cervical tissue up to a depth of 5 mm. there were four instances of glandular involvement. In six cases where the carcinoma involved the vaginal cervix, but was distinctly within its border, there was but one case of glandular metastasis.

Thus in seventeen cases of carcinoma confined to the cervix or the vagina there was in 30 per cent. infection of the lymph glands. This agrees quite well with Baisch's figures. In twenty-three advanced but operable cases Brunet found the glands infected with carcinoma thirteen times. In seven cases in which the disease had gone so far that radical operation was abandoned there were six in which the removed glands contained

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[1] Ergebnisse der Abdominalen Radikaloperation des Gebärmutterscheidenkrebse mittels Laparotomia-hypogastrica. II. Pathologisch Anatomischer Theil. Zeit. f. Geburtsh. u. Gynäk., 1905, lvi., H. 1, S. 1.

metastases. This altogether makes 51 per cent. of Mackenrodt's operable cases in which the glands were carcinomatous. Brunet made a further interesting observation in Mackenrodt's cases which shows the necessity of removing the upper third of the vagina in a radical carcinoma operation. He found in 42.6 per cent. of his cases that there were metastases to the upper part of the vagina. In 66 per cent. of these metastases the disease was submucous and, therefore, easy to overlook or impossible to discover clinically.

EARLY DIAGNOSIS OF CANCER OF UTERUS. As I have strongly urged for the past few years an early diagnosis is the most important factor in the prognosis and is more important than the technique of the operation. During the past year Runge[1] has given his hearty endorsement to Winter's scheme for increasing the operability of cancer cases. He agrees with him that it can only be done in two ways: first, by informing women of the symptoms of the early stages of carcinoma; second, by emphasizing to the practising physician the methods of diagnosis. In the early diagnosis of carcinoma of the uterus "every day, every hour is important." Runge draws attention to the fact that carcinoma beginning at the portio is easily seen, but that a carcinoma arising from the cervical canal may escape observation. In such cases a sound introduced into the cervix will find the carcinomatous area friable and soft unless it is a scirrhus growth. The double tenaculum used to catch the cervix in these cases will often cut through the cervix. This occurrence should direct one's attention to the possibility of cancer. If there is any doubt a piece of the cervical tissue should be excised and sent to a pathologist or the patient should be examined by a specialist at once. When carcinoma of the corpus is suspected diagnostic curettage is required. It is reprehensible in the physician to permit a patient in whom he has any suspicion of carcinoma to go without examination. If she objects to examination or diagnostic excision or curettage the ordinary means of persuasion should be tried. If these do not avail she should be told that a malignant condition is suspected. The physician should never wait for cachexia to appear, for when it does the cancer is usually inoperable. Caustics are absolutely contraindicated; at any rate under the notion that they will effect a cure. If the diagnosis of carcinoma is made and the patient refuses operation the responsibility of delay should be placed upon her.

It should be remembered that carcinoma begins without pain. The early symptoms are irregular bleeding and a watery or bloody discharge. Bleeding after coitus should awaken a grave suspicion of cancer. Return of hemorrhage a year after the menopause makes the diagnosis of carcinoma very probable.

As indicative of the interest that is being taken in the early diagnosis

[1] Die Heilung des Krebses. Die Therapie der Gegenwart, xlvi., Nr. 6.

of cancer, Hall[1] reports two cases where the disease was discovered very early by means of microscopic examination. Gellhorn[2] reports three additional ones. The microscope comes into play more, however, in fundus cases, where the early diagnosis is relatively less important than in carcinoma of the cervix. In carcinoma of the fundus the histological examination of scrapings will always be the first means of diagnosis. In carcinoma of the cervix where the parts are easily accessible it will not do much more for the experienced gynecologist than confirm his diagnosis. At least this is true at the present time. If cancer of the cervix is seen earlier than is now the clinical rule the microscope will become a more important aid in the diagnosis of these cases. Just now, as Runge has said, the most pressing need is to put the laity and physicians constantly on guard lest they overlook the early stages of this disease. To determine the earliest symptoms in carcinoma Craig[3] analyzed seventy-eight cases. In forty-five leucorrhœa, in twenty-one hemorrhage, and in twelve pain was the first symptom. From this he draws attention to the significance which leucorrhœa may have in patients at the age of life when carcinoma most frequently occurs.

TREATMENT OF CARCINOMA. The past year has been marked by the appearance of the views of a number of prominent workers in the practical side of the carcinoma question.

Wertheim has reported the result of his first series of carcinoma cases, while Mackenrodt, Bumm, Werder and others have outlined their present operative technique. The work of Wertheim and Mackenrodt deserves careful attention. Apparently they have consistently applied for four (Mackenrodt) and five (Wertheim) years their operative principles and now can give the exact statistics of their earlier series of cases. Pfannenstiel and Bovée have offered suggestions for the selection of the form of treatment in the particular case. Werner has put carcinoma statistics upon a firm basis. As a matter of passing interest we have reviewed a paper of Vassmer,[4] who reports an interesting case of permanent cure of an early adenocarcinoma of the uterus by means of curettage. The original diagnosis was made by Vassmer, who advised immediate total extirpation. This was not carried out although attempted. A subsequent curettage and histological examination showed the mucosa to be healthy, and a third curettage had a similar result. Vassmer's diagnosis

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[1] Early Diagnosis of Cancer. Lancet Clinic, Cincinnati, July 29, 1905, New Series, vol. lv., No. 5, p. 122.

[2] The Early Diagnosis of Cancer. St. Louis Courier of Medicine, March, 1905, vol. xxxii., No. 3, p. 142.

[3] The Early Detection of Uterine Carcinoma. New York Medical Journal and Philadelphia Medical Journal, vol. lxxxii., No. 2, p. 65.

[4] Ist durch die Abrasio eine Dauerheilung des beginnen des glandulären Uterus Carcinoms zu Erzielen. Archiv f. Gynäk., Bd. lxxv., No. 3, S. 668.

is verified by Aschoff, and the second and third diagnoses were verified by Orth. After noting the various proliferations and metaplasias of the uterine epithelium, which may be benign, and recognizing that histological diagnosis of these changes is not infallible, the author quotes v. Hansemann, who says that "what are to-day designated carcinoma are certainly not all of the same type, and what is named sarcoma, particularly, comprises tumor formations of the greatest variety." Nevertheless, says Vassmer, it can no longer be maintained that carcinoma is incurable if it cannot be radically removed. There are cases on record which disprove this and they cannot all be explained upon the assumption of an incorrect diagnosis. Orth and v. Hansemann acknowledge the possibility of a permanent cure of malignant new-growths after partial excision. Clinical experience, he says, speaks for the possibility of a regression of carcinoma particles left behind after an incomplete cancer operation. After such an operation Lomer has reported some remarkable cases of cure in carcinoma of the uterus. A. Czerny says that he can cure many inoperable cases of cancer of the uterus by a combined method of treatment viz., curettement with a sharp spoon and a firm tamponade of gauze moistened with 30 to 50 per cent. solution of chloride of zinc. Vassmer further speaks of the observations of Alsburg, Krönlein, Lindner, Hahn and others, that after simple gastroenterostomy previously palpable carcinomata of the stomach would disappear. Schuchardt and Alsberg encountered a peritoneal carcinoma which fully healed after cœliotomy. Rotter observed the same result in an inoperable malignant adenoma of the rectum. Lallemont described the spontaneous cure of a recurrence of a scirrhus carcinoma of the breast. Martin relates a case of microscopically confirmed scirrhus carcinoma of the portio in which the entire vault of the vagina and cervix was transformed into a crater; although operation was refused the patient was living after twenty-two years and required no medical attention. Sänger has recently reported a case of carcinoma (microscopic diagnosis) of the cheek in which he removed half of the tumor and the remainder underwent regression. Mohr has seen a similar case. Peterson has emphasized the possibility of retrogression of metastatic particles of malignant tumors in referring to the work of Goldmann and M. B. Schmidt. Goldmann found that carcinomatous masses frequently break into the bloodvessels. Metastases by the blood channels, however, are very rare, and Schmidt has recognized regression of metastatic particles on an extensive scale. The author asks in view of these facts and his own case whether a carcinoma confined to the mucosa of the uterus may not be radically removed through curettage. He reports Virchow as saying "carcinoma is at first, and often for a considerable time, a local disease and it is possible, therefore, at this time to cure it by local measures." These instances are merely quoted

because they are unique and vary from a well-nigh invariable law.   No
more serious mistake can be made than to take seriously any thought of
trying to cure carcinoma of the fundus, however early, by means of curet-
tage.

There is no doubt a great variation in the rapidity of growth and
in the destructiveness of different cases of carcinoma.   It has been
noted, and for a long time, that in the young and in the pregnant, in
women shortly after the puerperium, carcinoma is very malignant.   In
such cases, says Pfannenstiel, if they are seen early, no time should be
lost in carrying out the most extensive radical operation. To Bovée[1]
a family history of carcinoma is an argument against a radical operation.
In such cases, it has always seemed to him, there is always less hope of
cure, even from the most radical procedure. Also cases of long standing,
even though the local involvement does not appear to be very extensive, he
would be inclined to refuse radical operation.   Pfannenstiel[2] would
reserve the extensive abdominal radical operation for the case in which
there is a good chance of cure, or in which the only hope of cure lies in
early and complete eradication. Certain forms of carcinoma, therefore,
he thinks are better suited to complete abdominal hysterectomy with
removal of the glands, while other forms will do quite as well by a modern
vaginal hysterectomy.

As carcinoma of the cervix quickly becomes inoperable he believes the
only hope lies in an early recognition and a prompt radical extirpation
which includes the connective tissue of the broad ligament and the pel-
vic glands. Advanced cervical carcinoma does not give a favorable
outlook; the field of operability, therefore, should be narrow.

Carcinoma of the portio should be exposed to the radical vaginal
operation very early, with the most complete removal of the vaginal
vault, paracolpium, and parametrium. Advanced cases must be treated by
an obdominal operation. The border of operability is quickly reached,
and certain cases, even after the most complete operation, are certain
to recur; therefore, as soon as the case appears technically difficult and
the probable mortality high the radical operation should not be chosen.
Carcinoma differs in its degree of destructiveness and in its rapidity of
growth. The soft cancer which tends to degenerate is especially danger-
ous. The scirrhus form has a better prognosis. Histologically it con-
tains more connective tissue that is not so malignant as that contain-
ing less. The size, outline, and structure of the individual cells are
worthy of note. If in a tumor there are cells which vary from every

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[1] The Treatment of Cancer of the Cervix Uteri in Advanced Stages. American
Medicine, January 7, 1905, vol. ix., No. 1, p. 20.

[2] Wie erreichen Wir am besten das Ziel, den Uteruskrebs auf operative Wege zu
heilen?   Berlin. klin. Wochenschr, xlii., Nr. 27.

type, which are anaplastic, and indifferent and resemble embryonal cells, "which proteus-like appear in the most bizarre forms" (Kroemer), then the growth is very malignant. The form of the cell columns and nests is also important. If these points are closely observed and compared with the clinical course of the given case, with a little practice it may be possible to make a fair prediction as to prognosis from the histological examination. To first determine the histology of the given case of cancer and from that its prognosis is the postulate which Kroemer and Pfannenstiel have made. In this way the sort of case which tends to early gland infection will be determined; in early cases of this sort as radical an operation as possible will be advisable; whereas in cases advanced operation will be regarded as useless. In a general way, but dependent upon the age of the patient, the consistency and the histological structure of the particular growth, corpus and portio carcinoma, should be exposed to a vaginal operation; the cervical carcinoma to abdominal. It must be remembered that there is a very malignant growth of the portio (cauliflower cancer), while there is a slow-growing (scirrhus) carcinoma of the cervix.

For cauliflower cancer of the portio the abdominal operation is the best. In advanced cases laparotomy must be done before a reliable estimate of the extent of the disease can be gained. The prognosis here depends on the glands. The first act of the operator should be to expose them. If the glands are largely diseased, and this can be told with certainty only after splitting the peritoneum, the operation should be discontinued except in the hard scirrhus carcinoma of old women; in this form removal of the glands prolongs life and therefore is desirable. If one wishes to know during an operation whether certain glands are involved, microscopic examination should be made at once; in trained hands this requires ten minutes. Meanwhile, the operator may busy himself in exposing the ureters. The operation can be discontinued if the procedure appears useless.

Before we pass on to a consideration of the results which various operators have obtained in cancer cases it will be well to review the work of Werner,[1] who suggests a uniformity in the report of carcinoma statistics. The percentage of cures, as often given, is calculated simply from the number of operative cases, with no regard for the inoperable ones and none for those who have not survived the operation. This results in confusion and unintentional misrepresentation. He, therefore, thinks every surgeon who reports his results in carcinoma should specify: 1. The number of patients with carcinoma presenting themselves. 2. The number operated upon. 3. The number which did not survive

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[1] Zur Berechnung des "absoluten Heilungsprozentes" in der Statistik des Uteruskarzinoms. Zent. f. Gynäk., 1905, Nr. 1.

the operation.   4. The number permanently cured after five years. There are some sources of possible error even in this method which can scarcely be excluded, although this can be reduced to a minimum:

1. The variation in the operability of cases as they present themselves. There is no definite measure of the extension of a given case of carcinoma. Consequently the cases chosen for operation in different clinics vary in considerable degree according to the views of the chief of each clinic.

2. Cases which are operable but refuse operation.   The number is small and they may be left out of the records altogether.   A patient who has thus refused advice will, therefore, not influence the statistics.

3. Patients dying from intercurrent diseases.   In doubtful cases, as the likelihood of a recurrence is greater than that of a cure, they must be put down as instances of a recurrence.   But if a patient has remained healthy for five years she is counted as cured irrespective of her future condition.

If after two years a woman dies from some intercurrent affection, and postmortem shows no signs of a recurrence, either in the operative area or in the glands, the case should be reckoned as cured, for recurrence usually takes place within the first two years.   On the other hand even if there is no recurrence, postmortem, in a case under two years, it is counted as a recurrence.   As recurrent, also, are counted all those dying of intercurrent affections in which no postmortem was made, and those who have moved away.   In this manner a case really cured will be classed occasionally as a recurrence, but no case of recurrence can be classed as cured, and, though such a slight inexactness cannot be excluded, yet the balance is on the right side for trustworthy statistics.

It need not be said that if the operation were unattended with danger, perhaps every surgeon would admit that the advanced radical operation, with removal of the entire pelvic lymph system, would be the proper surgical treatment.   The danger of the radical operation is more or less in direct proportion to its extent and to the dexterity with which it is carried out.   Wertheim[1] attributes his high mortality in his first series of cases to the prolonged anæsthesia and to the imperfection in the technique.   The great majority of deaths, he says, were the so-called heart deaths, the end occurring within the first twenty-four to forty-eight hours, from a kind of collapse, without a trace of infection or peritonitis.   An improvement in his results was first noticeable when the first step of his operation, viz., the disinfection of the field of operation, was done without anæsthesia.   The curtailment of the duration of the operation, also,

must have had something to do with the improvement. While at first the operation required one and a half to two hours, at present, after an experience of two hundred and seventy cases, it varies from one hour to an hour and a quarter.

Bumm[1] draws attention to the dangers of sepsis following a carcinoma operation. According to his experience this is the chief danger of the operation (nine of Bumm's cases died from infection of the operative area and the peritoneum); besides this, injury to the ureters and the bladder, shock, and hemorrhage play a part. He thinks that much of the infection comes from the carcinoma itself. Bacteria may be found several centimetres distant from the surface of the tumor, as far as the lymph spaces of the parametrium. This explains the sudden attack of fever in carcinomatous individuals; it depends upon local septic processes in the neighborhood of the carcinoma. There is no wonder, therefore, that infection sometimes occurs in spite of every precaution. The author thinks that sepsis is to be especially feared in the women who have had febrile attacks before operation. It is clear that clamping of the vagina, as by Wertheim's clamps, cannot prevent bacteria from gaining access to the wound and to the peritoneum, through the tissue spaces. For the same reason, deep curettage of the carcinomatous area gives no security against infection. The red-hot iron acts scarcely 1 cm. below the surface. At all events there is a greater necessity for a more careful preparation of the carcinoma than for further improvement in the ordinary surgical technique. Bumm has used, with this object in view, in five cases of advanced and degenerating carcinoma, prophylactic inoculation with the streptococcus. A culture of this was obtained from a uterine carcinoma, and after being weakened by heat of various degrees, inoculations were made until there was a regular febrile reaction. This was done with the object of producing in the body a large amount of antistreptococcic material. Two of the patients in which this was done died of hemorrhage; in the other three there was an exceptionally smooth and afebrile convalescence.

Mackenrodt's[2] fatalities have come chiefly from albuminuria and nephritis. This the author has observed twenty times in seventy cases, and in eight instances there was a fatal result. Mackenrodt's preparatory treatment seems to be very effectual in disinfecting the operative areas. An old carcinoma, he says, contains organisms, commonly the streptococcus. With the view of destroying this infection he disinfects as far as possible

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[1] Zur Technik der abdominalen Exstirpation des karzinomatösen Uterus. Zeit. f. Geburtsh. u. Gynäk., Bd. lv., S. 173.

[2] Ergebnisse des abdominalen Radikaloperation des Gebärmutterscheidenkrebses mittels Laparotomia hypogastrica. I. Anatomie, Chirurgie und Klinik. Zeit. f. Geburtsh. u. Gynäk., 1905, Bd. liv., H. 3, S. 514.

the carcinomatous tissues by means of formalin. Furthermore, by the removal of a redundancy of tissue, a case which at first appears inoperable, twelve hours afterwards often presents an entirely different impression, and the subsequent operation is done without any difficulty. The preparatory treatment which Mackenrodt carries out consists of the usual regulation of the bowels; local preparation with curettage of the exuberant carcinomatous tissue; the use of a formalin tampon. This is done without ether. A sharp curette and scissors are used. There is little pain but much hemorrhage. A strip of gauze well wrung out of 10 per cent. commercial formalin is packed into the bleeding crater and the vagina to within a short distance of the introitus. Vaselin is smeared thickly over the vulva and the region of the anus, as well as the inner surface of the thighs. For a few hours the patient complains of sharp pain, which depends on the action of the formalin upon the vagina and the pelvic connective tissue and lymphatics. After the tampon has been in place twelve to fifteen hours, directly before the operation it is removed. At this time the vagina and the carcinomatous cavity feel crater-like and leathery. The effect of such an application is seen, during the operation, in a lessened liability of the carcinomatous crater to tear into the surrounding tissues and in an œdematous condition of the pelvic connective tissue. When the formalin tampon is left in for more than fifteen hours a hardening of the pelvic connective tissue ensues which will form a serious hindrance to the operation. The further action of this agent may result in necrosis of the bladder, the ureters, and the rectum. For this reason preparatory treatment by means of formalin should never be made unless the exact time of operation is positively determined, and then not more than twelve or fifteen hours preceding it. Just before the operation, during the cleansing of the abdomen and the external genitalia, the formalin tampon is replaced by one of corrosive sublimate.

The real value of any particular form of operative treatment will be indicated by its remote results and these results and the operation can then be compared. But it is necessary that they be reported uniformly and that certain precautions are taken. First of all it is to be emphasized that the carcinoma question, so far as it relates to the operation, does not need to concern itself with corporeal carcinoma. The prognosis in these cases is very favorable, and vaginal hysterectomy is followed, as noted by Baisch, with the cure of 100 per cent. (Döderlein, Fritsch, Landau) of those surviving the operation. We are, however, thoroughly concerned with cancer of the cervix, and every author in giving his results should keep cervical carcinoma distinctly separate from corporeal. He should, further, bear in mind the suggestions of Werner, and in this way give an absolutely reliable estimate of his work.

Wertheim has given us a most admirable review of his own work and reports a series of cases, his first, which are five years old. For the purpose of demonstrating the accuracy of his statistics, Wertheim says that his figures are the results of formulas given by Werner, Winter and Waldstein. Thus his absolute percentage of cures he represents by A, after five years by A^5, after four years by A^4, etc. This is obtained by following Werner's suggestion: The formula given to find this result is:

$$A = \frac{O \times D \times (100 - M)}{10,000}$$

O denotes the percentage operated upon of those seeking relief.

D denotes the percentage of those operated upon which remain free of recurrence.

M denotes the percentage of primary mortality; that is, that due to the operation itself, whether recent or remote.

Wertheim's results are as follows:

$A^5 = 11$ per cent. In this series O = 29.2 per cent.; D = 70 per cent.; M = 46 per cent.

$A^4 = 23.47$ per cent. In this series O = 45 per cent.; D = 63.3 per cent.; M = 18 per cent.

$A^3 = 25.8$ per cent. In this series O = 48 per cent.; D = 61 per cent.; M = 12 per cent.

$A^2 = 24.4$ per cent. In this series O = 48.6 per cent.; D = 65 per cent.; M = 22 per cent.

Mackenrodt's statistics, which approach Wertheim's in completeness, and the duration of time which has elapsed since be began to perform his operation, are not given in the same manner as those of Wertheim and, therefore, cannot be strictly compared with them. Thus, Mackenrodt groups his percentage of cures in relation to the extent of the carcinomatous disease at the time of the operation. Brunet gives a detailed resumé of each case, however, and it is possible, therefore, to get an idea of his results as compared with Wertheim's. From a study of his seventy cases we find that of those patients whom he exposed to his advanced radical operation at the end of four years there were:

Cured	5
Operative deaths	2

At the end of three years:

Cured	9
Operative deaths	3

At the end of two years:

Cured	10
Operative deaths	5
Recurrences	1

11

At the end of 1 year:

Cured	10
Operative deaths	2
Recurrences	4
	—
	51

Of 19 cases exposed to unradical operation:

At the end of 2 years:

Cured	3
Recurrences	3

At the end of 1 year:

Recurrences	11
Operative deaths	2

We cannot compare these statistics with those of Wertheim's because the author himself does not group them in series according to the year, nor does he indicate the average percentage of operability. At present he says 90 per cent. of his cases are operable.

With an operability of 90 per cent. his absolute cure percentage would be expressed by:

$$A = \frac{90 \times 52.85 \, (100 - 20)}{10,000} = 38 \text{ per cent.}$$

With an operability of 50 per cent. by:

$$A = \frac{50 \times 52.85 \, (100 - 20)}{10,000} = 24 \text{ per cent.}$$

This looks better than Wertheim's figures, which average for his entire four series 21 per cent.

Bumm's statistics are as follows: $A^2 = 27; O = 80; D = 41; M = 18$.

The details of the operation, as carried out by these men, vary in several details. They all emphasize the importance of removing a great deal of the parametrium and of handling the ureters with great care. The ureters are deliberately exposed by each one and separated from the surrounding parametrial tissue. Bumm and Mackenrodt seem more disposed to glandular extirpation than Wertheim, who has given up this procedure as a routine measure. All of them use the median incision save Mackenrodt, who insists upon the bow-shaped hypogastric incision. Mackenrodt has, by all means, the most radical operation. He gives the fullest details of the operation and includes in this manner a large number of anatomical points which appear to be of great importance. It is a ready inference from Mackenrodt's paper, from the attention which he gives to detail, that he has mastered the *anatomy of the pelvis*. As he himself declares, it is only by preparatory work on the cadaver and by repeated observation of the operation upon the living that one could be able to carry out his technique.

The difference between his operation and the others, which will be described, lies in the separation of the vagina, paracolpium, and the parametrium from the rectum and the pelvic floor. His operation is very much like that of Bumm up to the point of incision into the vaginal wall. After separation of the ureters, division of the ovarian, round ligament, and uterine vessels, the essential parts of Mackenrodt's operation find their place. He makes a great point of the clean, blunt separation of the parametrium from the sides and floor of the pelvis in contradistinction to ligation and division of it at the pelvic wall or base. The stumps remaining behind, in the latter event, he says contain the particles from which recurrences arise. The lower and the external parts of the broad ligament, which Mackenrodt describes as the pelvic parametrium, consist of numerous diverging strands of fibres which pass in all directions to, and merge with, the sacral pelvic fascia, the obturation fascia, the rectum, and the peritoneum of Douglas' pouch. These strands correspond in part to the lymph and the bloodvessels of this region, and especially to the veins which empty into the hypogastric vein. The fascial sheath of the hypogastric vein is the most prominent point of convergence of the parametrial roots.

There are three groups of veins in connection with the pelvic parametrium, which from a surgical standpoint, are of the greatest importance; the prompt and deliberate control of which prevents unnecessary loss of blood and shortens the time requisite for separation of the parametrium to a few minutes; the neglect of this precaution may result in serious loss of blood, sufficient to either considerably lengthen the operation or even to seriously threaten or take the life of the patient. The anterior division empties into the obturator veins and anastomoses with the vesicovaginal venous plexus; the middle division into the hypogastric, and the posterior communicates with the sacral and the hemorrhoidal veins, and partly with those of the rectum. The obturator nerve runs between the hypogastric roots of the pelvic parametrium. It is covered by a thick packet of glands which are considered a part of the hypogastric glands. Some of the thicker parametrial roots pass beneath the folds of Douglas and, surrounding the rectum, take an upward direction toward the promontory; branches of these are inserted into the upper part of the sacrum at the side of and beneath the rectum. The small venous branches above described as well as a rich anastomosis of lymphatic channels accompany these strands. There are fine lymph radicals which accompany these radical roots and venous branches. With the anterior division are lymph radicals which pass to the internal inguinal glands; with the middle are radicals which empty into the hypogastric glands; with the posterior upper division are radicals which pass to the sacral and the prevertebral glands of the lumbar vertebra. The larger radicals, including the ureteral

glands, accompany the uterine vessels and empty mostly into the iliac glands; less often, also, they reach glands at the bifurcation of the aorta; the iliac glands also receive a flow from the anterior branches and from the inguinal region.

The paracolpium is a direct continuation of the uterine parametrium and extends below nearly to the levator ani. The paracolpium and the uterine parametrium are, developmentally as well as anatomically, common structures; the pelvic parametrium is in connection with both. The larger pelvic veins, except the hypogastric, do not have a close connection with the parametrial roots already described. The uterine, the superior and the inferior vesical, and the iliac veins have no close relation with them. The same is true of the ureter. Injury to the ureter, therefore, or to these veins is not to be feared in the separation of the parametrial roots; on the contrary, injury to the hypogastric and obturator veins, and to the connection of the latter with the vesico-vaginal plexus can only be avoided by deliberate and careful dissection of them and ligation of their roots. The ureter is connected with the upper lateral pelvic wall by a nearly avascular, delicate, transparent connective-tissue membrane. This extends from the point where the ureter crosses the iliac vessels to the point where the ureter penetrates the parametrium. The cellular tissue and the vessels of the upper part of the broad ligaments have no close connection with the pelvic wall and hang to it only because of the relations of their peritoneal investment; after ligation and division of the ovarian vessels and the infundibulopelvic ligament, this cellular tissue can be easily pushed off from the sides of the pelvis without any noteworthy hemorrhage; the roots of the uterine vessels are in this way exposed, and the ureter is carried inward with the posterior lamella of the broad ligament.

In the preparation of the ureter it is not important to conserve the ureteral membrane described by Mackenrodt. As the ureteral sheath is supplied with blood from the vessels above the pelvic brim and from those of the bladder it is unnecessary to retain the ureteral artery; to do so, increases the difficulties of the operation. It is of more importance to preserve the connection of the ureter with the peritoneum, at least wherever there is an intimate attachment. The technique of each operation is given below.

Details of the Wertheim Operation. After a careful preliminary treatment of the cancer per vaginam by scraping and burning it with a Paquelin cautery, and after a minute disinfection, the patient is placed in Trendelenburg's position and the abdominal cavity opened by a median longitudinal incision between the symphysis pubis and the umbilicus.

1. By dividing the posterior layer of the broad ligament, the ureters, which appear through the peritoneum are exposed up to their entrance

into the parametrium. It is necessary to avoid isolating them all around, and their surrounding vascular network must be spared as much as possible.

2. After dividing the peritoneum the bladder must be separated from the uterus.

3. Then follows the ligation and division of the infundibulopelvic and the broad and the round ligaments. The order in which these first three steps follow each other may be varied.

4. The next step is the ligation and division of the uterine vessels with the surrounding cellular tissues. For this purpose the following manipulation serves: the index finger of one hand is pushed along the ureter, through the parametrium toward the bladder until the tip of the finger appears there; the vessels are then raised on the finger which covers the ureter, so that the ligation and division of the vessels can take place without injury to the ureter. The bleeding of the uterine ends of the vessel is stopped by clamps or ligatures.

5. As soon as the uterine vessels are divided the vesical portion of the ureter has become easily accessible, and the preparation of the ureters can be completed. In simpler cases the pars vesicalis separates without any difficulty, partly by using the end of the finger, partly with a few strokes of the scissors, and the bladder itself is separated in its deeper part from the tumor and from the vagina. If the ureter is fixed the advantage of the abdominal route is most apparent, as, by a careful preparation, one can separate even firmly fixed ureters without any danger to them.

6. Next follows the division of the posterior layer of the peritoneum and the separation of the rectum from the vagina. The isolation of the carcinomatous organ has now been sufficiently effected and its removal follows.

7. For this purpose the two layers of the parametrium are taken off as close as possible to the pelvic wall and—

8. The vagina is cut across. The seventh step can be carried out without any loss of blood by applying to both layers of the parametrium, before dividing them, four or five bent clamps at each side, which can be replaced later by ligatures. Before the eighth step is commenced the vagina is cleaned out again by wiping with dry sterile gauze. To avoid infection from the cancer strong clamps are applied to the vagina before its division, so as to isolate the cancer from the vagina, which is divided below these clamps. Bleeding from the paravaginal tissue is stopped by stitching around the vaginal stump. The division of the vagina, after the application of such clamps, is preferable to the procedure at first adopted, namely, that of extracting the uterus through the vagina on account of the more effectual control of bleeding.

9. For the purpose of removing the lymphatic glands in the neighborhood it is necessary to prolong the incision of the peritoneum upward. The great iliac vessels are, as a rule, already bare; if not, a blunt division of the cellular tissue with the fingers will suffice. Every lymphatic gland at all enlarged, in the region of these vessels, up to where the aorta divides and downward as far as the obturator foramen, must be extirpated. The bleeding must be carefully checked.

10. The wound must be treated as follows: The cavity created by the removal of the tumor is filled in loosely with iodoform gauze, which extends to the vulva. An exact closing of the peritoneal cavity over this gauze drain is effected by sewing together over it the anterior and the posterior flaps of the peritoneum. The final step is the suture of the abdominal incision in layers.

Mackenrodt's Operation. Mackenrodt employs a bow-shaped incision. This begins about two fingers' breadth above the symphysis; the skin is cut through transversely and then the incision is continued on each side from the border of the rectus, in a curve upward, to the level of the anterior superior spine. The entire incision is bow-shaped with its convexity downward and about parallel to the anterior wall of the pelvis. Two small cutaneous vessels are cut, but bleed very little and need nothing but temporary pressure with a gauze pad. The insertions of the recti are now divided on each side, one to one and a half finger's breadth above the symphysis. After the rectal fascia has been divided across the linea alba and the subperitoneal fat appears in the median line the forefinger is passed under the rectus first on one side and then on the other, and the preperitoneal fat and peritoneum being pushed to one side and downward the entire muscle and fascial sheath are divided transversely with scissors. The peritoneum with the epigastric vessels is then pressed downward and, with scissors upon the fingers, the oblique muscles are divided throughout the course of the skin incision. The peritoneum is now divided above the bladder, from one set of epigastric vessels to the other. The tongue-shaped flap with its peritoneal lining is now pressed backward and the peritoneum of the flap clamped to the peritoneum of the posterior pelvic wall. The skin surface of the flap is covered with gauze. In this way the abdomen is fully closed off from the pelvis.

The operation is begun by incising the peritoneum between the bladder and the uterus; the incision is continued over the round ligament, the top of the infundibulopelvic ligament, and the posterior layer of the broad ligament to the posterior pelvic wall, passing across the rectum just above the fold of Douglas. This incision is made first on one side. The ovarian vessels are carefully isolated through this incision, tied with catgut, cut, and allowed to retract under the peritoneum. In carrying the peritoneal incision over the posterior surface of the broad ligament

to the pelvic wall, and across the rectum, the peritoneum should be held upward with some appliance shoved beneath, and the relations of the ureter carefully borne in mind so that this important structure is not injured. When the peritoneal incision nears the rectum, the uterus is drawn forward by an assistant while the operator lifts up the rectum with the left hand and incises the posterior peritoneum of Douglas' pouch just below the point where it becomes firmly fixed to the rectal wall. The round ligament is now secured and divided. By drawing upward on the broad ligament the connective tissue and fat of the latter may be easily separated from the pelvic wall by a sponge down as far as the levator fascia and the origin of the uterine artery.

The ureter with the broad ligament is carried toward the median side. This same procedure is now carried out on the opposite side. The uterine arteries are then tied at their point of origin and divided, a clamp securing the uterine end of the artery to avoid a back flow of blood. By separating the fibres of the parametrium the ureter is found and easily separated from its sheath as far forward as the anterior part of the parametrium, beyond the point where it is crossed by the uterine artery. The same amount of exposure is now made on the opposite side. Before the ureter can be separated from the paracolpium up to its entrance into the bladder the latter must be separated from the cervix and parametrium. When the tissues are not infiltrated with carcinoma or inflammatory products, this is easy in the median line as far as the point of entrance of the ureters into the bladder wall. At this point the connection between the bladder and the vagina becomes very close. The separation of the parametrium from the base of the bladder is not so easy. It may be accomplished by a careful dissection of the superior and the inferior vesical arteries which must not be injured. In separating the bladder from the parametrium, small, venous branches will have to be cut. Some of these may be closed by pressure or by temporary clamping. Ligatures in this area must, as far as possible, be avoided because of the danger they carry to the integrity of the bladder. With the ligation of the four principal vessels of the uterus and the isolation of the bladder and ureter, the preparatory steps of the operation are completed.

There now follows the particular part of the operation, and this consists of the separation of the roots of the parametrium and paracolpium from the fascia of the obturator internus, levator ani, and the iliac fascia. After removing the sublimate vaginal tampon the uterus is drawn upward toward the navel so that the vagina is on the stretch. The anterior vaginal wall is now completely divided from side to side near the level of the insertion of the ureters into the bladder. The lateral wall of the vagina is secured with clamps. The posterior wall of the vagina is now cut through without carrying the incision deep enough to injure the

underlying rectum. The upper border of this posterior incision is caught with clamps and drawn upward, while from the sides, carefully pushing the rectum backward with gauze sponges, the posterior vaginal wall is entirely separated. The anterior and the posterior vaginal cuffs are now clamped together, thus closing the vaginal tube and securing a good means of traction in the further separation of the bladder, para-colpium, and parametrium. Upon drawing upward the vaginal cuffs the rectum is easily pushed backward; the parametrial roots are then easily separated from the sides of the rectum, and beneath this from the sacrum. Laterally at the insertion of the anterior parametrial root there is more resistance. In this situation the vessels of the anterior root, which empty into the obturator veins and the anastomosis with the bladder must be carefully exposed and ligated close to the obturator vessel without injury to the latter. When the anterior root has been freed by pushing it away from its attachments with small blunt pieces of gauze, protecting the obturator vein during this time from insult, the vagina and para-colpium are bluntly dissected from the rectum, sacrum, and lateral pelvic wall. A few of the stronger fascial threads may be snipped with the scissors. The vessels of the middle root which empty into the hypo-gastric are lightly tied and divided. The connective tissue of this root is then easily pulled away from its insertion.

Some small veins about the rectum and upon the anterior surface of the sacrum bleed slightly and are closed by temporary tamponade. The upper root contains usually a small vein passing to the hypogastric; this is tied. The connective tissue is now easily separated from the sides of the pelvic wall. This comes away, pulling out from beneath the peritoneum in long strands, which include the lymph glands of the sacrum and the rectum and the glands along the uterine artery commonly but incorrectly spoken of as the ureteral glands. All of the pelvic glands exposed during the operation and embedded in or connected with the parametrium may be removed along with the parametrial tissues. Usually this includes the rectal and the sacral glands and those of the broad liga-ment, uterine glands. It is only necessary, therefore, to free the obturator, internal, inguinal, and iliac glands; these are more accessible after radical removal of the parametria.

The dissection of the lymphatic tissue may be discontinued as a rule at the lower third of the common iliac. If necessary, of course it may be continued higher. The abdominal incision is closed after a light gauze pack has been placed in the vagina and the vesical peritoneum has been sutured to the rectum and to the posterior margin of the peritoneal incision on the side. In this way the entire raw area is covered. In placing the gauze-drain care is taken to protect the ureters from coming in contact with it and the drain is so placed that it exerts little pressure.

Bumm's Operation. Bumm has performed the radical operation for carcinoma according to the technique of Clark and Kelly, Wertheim, Mackenrodt, Krönig and others. In easy cases, he says, each of these procedures are good, but in difficult ones they leave something to be desired. His own technique permits operation with very little loss of blood; the parts are quickly exposed and each part of the operation follows the previous one smoothly. He uses a median incision. When the patient is very stout, in order to gain more room he divides the inner fibres of the rectus just above the symphysis pubis. The fascia is preserved intact. At the close of the operation the incision into the muscle should be repaired. The pelvis of the patient is considerably elevated and the intestines packed off from the general peritoneal cavity. The ovarian vessels on both sides are ligated doubly, the infundibulopelvic ligament cut between the ligatures and carried to one side. The peritoneum is now divided from the point of ligation outward and upward to the insertion of the meso-sigmoid on the left and to the mesocæcum on the right side, and from these points downward over the round ligament to the cervicovesical attachment. In doing this the round ligaments are ligated and cut. By now drawing apart the margins of this incision with the finger or a piece of gauze the important iliac vessels and the ureters are quickly brought into view. No hemorrhage occurs from this procedure. To the outer and upper part of this area the common iliac and its point of division is found. By drawing the posterior layer of the broad ligament, to which the ureter is fastened, toward the median line, the origin of the uterine artery, which as a rule arises in common with the superior vesical artery from a short branch of the hypogastric, is exposed to view. At the same time the glands of the vascular triangle and those along the common and external iliac arteries will be uncovered (hypogastric, common, and external iliac glands).

The exposure of the vascular triangle is the key to the topography of the region. This done, the ureter and the vessels are exposed by dissection The direct exposure of the uterine arteries and the ureters, as described and illustrated by myself, and then recommended by Amann, Krönig and others, is not so easy and not always accomplished without tearing some of the venous channels. The same is true of the undermining of the uterine vessels after the fashion of Wertheim, in which one bores with the fingers along the ureters. Bumm has in this way repeatedly caused serious venous hemorrhage in the depths of the wound through injury to venous plexuses. After the vascular triangle has been freely exposed the glands which come into view in the triangle and upon the iliacs are loosened. To keep the wound free of blood small branches are ligated as they are torn. When the glands, with the

contiguous fatty and connective tissue, are freed the division point of the common iliac, the external iliac, and the hypogastric arteries, with their accompanying veins, lie exposed as if by dissection. The uterine artery is now ligated doubly and divided either in common with the superior vesical artery or isolated from it. The accompanying small veins are at the same time ligated.

The entire vascular string with the surrounding fatty tissue, together with the lymph vessels and the glands, may now be drawn toward the median line; the ureter which up to this time has been exposed only above the point where it is crossed by the artery is now laid free by means of a few blunt strokes as far as the bladder. The separation of the ureters from the tissue beneath must be complete, for the short distance between the point where it is crossed by the artery and the bladder, for it is necessary to extirpate the underlying tissue with it and to secure the largest division of the uterine veins. The uterine vein, as a rule, leaves the uterus in two branches: the smallest running above the ureter along the artery, the larger, often as thick as the quill of a feather, runs beneath the ureter. The two unite just before the common stem empties into the hypogastric vein. When the ureter is fully separated and pushed toward the median line the larger branch is laid free and ligated.

The remaining steps of the operation comprise the removal not only of the cervix and the upper part of the vagina, but also of the paracervical and the paravaginal tissues, in as wide a circumference as possible, up to the pelvic wall and down to the pelvic diaphragm. This is much more important than the removal of the glands. The division of the vaginal walls is made according to the position of the greatest ex ension of the carcinoma, which varies in nearly every case. If, for example, the anterior vaginal wall is most affected the vagina is cut into from Douglas' pouch after first separating the paravaginal cellular tissue in this situation from the peritoneum. A fresh piece of gauze is placed over the cervix and the entire circumference of the vagina divided. Pulling the uterine mass upward the anterior vaginal wall and the surrounding cellular tissue is separated from below, and by keeping the parts on tension and separating the bad areas last the carcinoma is pedunculated there and dug out the most deeply. When the direction of greatest extension is posterior or to either side, the procedure is modified to suit the case. The easy side is always taken first. After removing the specimen very careful hæmostasis is made. The vaginal stump is hemmed around and the borders of the peritoneum from the insertion of the mesocæcum on the right are brought together with a running catgut suture. This unites the serous coat of the rectum in the middle line with the serosa of the bladder. After the abdominal incision is closed a gauze tampon is placed in the vagina, which is removed after twenty-four hours. Its

object is to press together the wounded pelvic surfaces. Bumm does not use any special drainage of the pelvic cellular tissues; the wound secretion easily finds access to the vagina without it, and drains may promote necrosis of the ureters and lead to prolonged suppuration.

The time required for this operation in the average case is one to one and a half hours: fifteen to twenty minutes for the exposure and ligation of the vessels and isolation of the ureters up to the bladder; twenty-five to thirty minutes more to separate the carcinoma and its environs; the rest of the time is occupied in hæmostasis and the closure.

Kelly's technique is briefly given as follows:

1. Clean up the cervix by thorough curettage.

2. Until one has general experience in locating the ureters it is of service to catheterize them.

3. Make a median abdominal incision by preference. Poten's incision may be used with great satisfaction, but it is time consuming.

4. The posterior peritoneum is opened at the infundibulopelvic ligament, and the peritoneum of the pelvic wall is drawn toward the median line. The ureter goes with this and ought not to be detached from it (Sampson).

5. A little further dissection exposes the uterine artery at its origin, where it is to be tied.

6. The bladder is freed and the vesical end of the ureter clearly exposed.

7. One has now to deal with the base of the broad ligament, which is the crux of the situation; the first step is to tie the one or two large veins crossing the ureter and divide them.

8. The ureter is now bared from end to end in its pelvic portion, but at no point detached.

9. One now proceeds to free the ureter from the broad ligament and to lift it up to one side. This must be done with the utmost gentleness, avoiding pinching, squeezing, or pulling the sharp flexions, so as not to hurt the delicate ureteral vessels, thus avoiding a common cause of ureteral fistula.

10. Both broad ligaments thus freed, one then ligates and divides the tissues posterolateral to the cervix ureterosacral folds.)

11. The posterior peritoneum is then divided and the uterus dissected free and drawn farther up.

12. The large veins under the ureter are now ligated at a distance from the uterus and the vagina is thus approached well below the disease and—

13. Divided with a cautery.

14. The ureters should now be covered in by drawing up the peritoneum over them and stitching it high up.

Kelly uses a vaginal drain in all of these cases, and would only close

the wound in the rarest instances. He emphasizes the importance of using long instruments for work deep in the pelvis and of packing off with a tremendous packing the intestines from the operative area.

It is a pleasure to see that Kelly has at last come back to the abdominal operation and has abandoned the piecemeal vaginal hysterectomy which he advocated three or four years ago. As I said in review of the operation which Kelly advocated, of first the bisecting of the uterus, and then the piecemeal extirpation of each half of the uterus, it was a very wide departure from principles which had been previously advocated in the extirpation of cancer in every part of the body. As I could not, therefore, approve of this operation, I am now delighted to see that Kelly tacitly admits its defects by advocating a principle of operation similar to the one which, with the exception of a few details, we worked out in his clinic in 1894 and 1895.

From the foregoing pages it will be seen that all of the radical operations embody Freund's original underlying principles, and that they differ only in matters of detail. All have for their object the wide extirpation of local tissues, and some lay especial stress upon the extirpation of the lymph glands. While I (as I have constantly repeated within the last four years) am skeptical as to the results of the very extensive operation, and while my opinion is very definitely fixed upon this point, I am nevertheless still open to conviction, and if time shows that Wertheim and his followers have made a marked appreciable advance in the ultimate results following operation I shall be glad to return to their principle. My own experience, however, does not confirm their results, and until the weight of evidence is distinctly in their favor I do not feel that I am justified in prolonging an operation, and thus greatly jeopardize the immediate results in order to grasp for the less tangible after results.

Another point, it seems to me, has been entirely everlooked in all of these discussions, and that is the serious dangers of many local injuries which may occur. If, therefore, I were to offer any advice based upon my personal experinece, I would say to the surgeon who has not had an extensive experience in abdominal operations that he should make haste slowly in attempting these radical operations. Only the man thoroughly skilled should attempt them. The man less skilled will, I believe, in a given series of cases obtain better results by confining himself to less radical measures than if he attempts these more extensive procedures.

In the foregoing pages I have discussed very fully not only the exact details of the various radical operations which have been performed, but have also endeavored to give a full and unbiased resumé of the results. Wertheim and Mackenrodt in their last reports have shown better results

than have been secured by other operators. In considering these results we must remember that both of these men have given very close study to operative technique and have, therefore, become very much more skilled than the average abdominal surgeon will be in the same class of operations. We must also not lose sight of the fact that notwithstanding this increased skill the mortality in Mackenrodt's cases is frightfully high and that of Wertheim still far above that of the average difficult abdominal section.

While from their reports we must grant that they have shown better remote results than any hitherto published, at the same time the question must come prominently into the foreground in discussing this question. Can these results be duplicated or even be approached by the average operator the country over? Without the slightest hesitation I would say no. Therefore, it seems to me we come back to the original proposition, which I stated in last year's PROGRESSIVE MEDICINE, that the extremely radical operations which have as a step the extensive dissection of the lymph glands, closely associated with the large veins and the deeper cellular tissue of the pelvic wall, carry with them such grave operative dangers that it would be best to leave out this step in the operation and confine ourselves to the radical extirpation of the locally involved tissue—the vaginal vault and the parametrium.

My own rule is to remove one or more glands for microscopic examination, provided they are palpably enlarged and easily accessible. If metastasis is found the prognosis is inevitably bad. Of these various methods I adhere to the abdominal operation. This I carry out most radically with the actual cautery, so far as the vagina and parametrium are concerned and in this I revert to the principle so strongly insisted upon by Russell after his study of forty-eight vaginal hysterectomies in the Johns Hopkins Hospital. He found almost invariably that there were recurrences at the site of the vaginal scar and not in the more or less widely remote metastatic areas. The rule, therefore, by which I work is to remove all possible tissue in the vicinity of the primary site of the growth, using the cautery rather than the knife. In general the principles laid down in Wertheim's latest publication are followed, which consist in the removal of a considerable cuff of the vagina with the uterus, and as much parametrium as is possible, but not prolonging the operation by a dissection of the glands. In acting upon this principle I am influenced by the fact that as yet no operation has saved 50 per cent. of cases, and that of Wertheim's operable cases 59 per cent. showed no glandular metastasis, while even in the far advanced cases of Schauta there were 43 per cent. free of lymphatic involvment, and that of the remainder which were involved only 13 per cent. could have had their chances of a more radical cure enhanced by removal of the glands. This small percentage of possibility

is at least equalized or more than offset by the much greater immediate mortality of the very radical operation.

Werder[1] has abandoned the *radical abdominal operation for carcinoma of the cervix*. Although he says the radical operation for carcinoma of the cervix has increased the percentage of cures the improvement has been largely at the expense of the death rate. Thus he says the average death rate among seventeen well-known surgeons (as computed by Gellhorn) is 21.5 per cent., or about four times that of vaginal hysterectomy. He quotes Olshausen as reporting 38.85 per cent. of cures after five years in one hundred and sixty-nine cases surviving radical hysterectomy for carcinoma. In these cases there was a mortality of 6 per cent. These considerations induced Werder to abandon his radical abdominal operation some years ago.[2] At that time his attention was directed to the work of Byrne. By his method of extirpation by means of the cautery Byrne operated upon three hundred and sixty-seven cases of cancer of the uterus, of which at the end of five years 19 per cent. were still alive, a result quite remarkable when we consider that it was obtained by a simple minor operation without a single death. Byrne placed great reliance upon the thermal effect of his method upon the wound surfaces and edges left after the operation.

He believes that "there is hardly any doubt that the developmental activity of the cancer cells or germs in certain stages and under certain conditions may be arrested or permanently destroyed by a degree of heat much below that which would be detrimental, if not destructive, to normal tissues; it is certain that the thermal agent exerts some modifying influence upon pathological processes much beyond and deeper than the surface actually cauterized, hence the importance of repeated applications, so that every spot suspected of contamination may be thoroughly charred."

Werder at present does a vaginal hysterectomy in which the principal features of the Byrne operation are retained, viz., thorough and repeated cauterization of all wound surfaces and edges. His technique, in his own words, is as follows: "The cervix is curetted with a heavy sharp spoon until all necrotic tissues are removed, and the bleeding surfaces cauterized until all oozing is controlled. The cervix is then firmly held by volsellum forceps and an incision is made entirely around the cervix at a considerable distance from the affected area by means of the cautery

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[1] The Byrne Operation and its Application in the Radical Treatment of Cancer of the Uterus. American Journal of Obstetrics, November, 1905, vol. lii., No. 5, p. 700.

[2] As mentioned above the figures of Olshausen and of Byrne, quoted by Werder, are misleading. Neither of these authors definitely separates carcinoma of the body from carcinoma of the fundus. Neither of them includes the percentage of operability or of primary mortality. Therefore, it would appear that Werder's conclusions were not based on reliable statistics.

knife, keeping it at a dull heat and never turning on the current until the knife is placed against the tissue to be burned. In this manner no oozing will take place and the parts will remain perfectly dry. While making traction upon the cervix the dissection is carried up carefully between the bladder and uterus, an assistant with a retractor drawing the bladder well away from the hot knife. With the aid of the index finger the peritoneum is then reached and opened with blunt scissors. Douglas' pouch is opened posteriorly in the same manner and the lateral vaginal attachments are burned through. The bladder is then widely separated from the uterus and broad ligaments by inserting the index fingers of both hands, with the palmar surface toward both pelvic walls, and making firm lateral traction. The fundus uteri is then seized with volsellum forceps and dragged down into the vaginal outlet, while a broad retractor in the hands of an assistant holds up the bladder against the symphysis pubis and well out of the way during the subsequent steps of the operation. Pads are now introduced into the pelvis to hold back and protect the abdominal contents. Ordinary heavy clamps are then applied to the whole broad ligament, first on one side; two usually being required on either side. The same procedure is then repeated on the other side and the entire uterus and appendages removed. Thus far the operation differs very little from the old clamp method of vaginal hysterectomy, excepting that all incisions have been made with the cautery knife. After packing off the pelvic cavity very carefully with gauze pads the upper clamp on the infundibulopelvic ligament is seized, the ligament put on the stretch, and a Downes' electrothermic clamp applied externally to it; it is protected by the shield and additional pads, if necessary, and the tissues included in the forceps are then thoroughly cooked until a good ribbon is obtained. The Downes' clamp is then removed, the ribbon cut through near its inner edge, and, if after a few moments no bleeding occurs, is dropped. The next clamps are treated in exactly the same manner until both ligaments and all other uterine attachments have undergone this cooking process. The large, broad Downes' clamps should always be used in this operation, as the smaller forceps is scarcely sufficient protection against bleeding, the narrow ribbon often opening up immediately after the clamp is removed, requiring ligation of the bleeding vessels, while the larger broad ribbon scarcely gives any trouble. Careful attention should be given to the oiling of the clamp surfaces, as neglect in this matter frequently causes a baking of the boiled tissues to its surfaces, thereby preventing the formation of the desired paper-thin ribbon, and resulting in free hemorrhage. If no bleeding is observed for a period of one minute the stump can be safely dropped and hæmostasis is fully as secure as by means of ligatures. The application of the ordinary clamps and the removal of the uterus first before resorting to Downes'

instruments gives the operation this distinct advantage, that the field is under better view and control, and by using the clamps on the broad ligaments as handles, we can expose a larger portion of the ligaments and get a better bite with the Downes' instruments than would be possible if we applied the latter while the uterus is still in situ. Particularly is this the case with the base of the ligaments or parametria, on the extensive removal of which the successful issue of many cases will depend. The last step of the operation is another cauterization of the stumps. For this purpose the parametrial pedicles are gently grasped with forceps, and after the surrounding tissues are carefully protected with pads, they are completely seared and charred with the dome-cautery. It will be seen that the Byrne theory of thorough and repeated cauterization is carried out literally in this operation, because not a single structure from which extension of the disease might occur escapes repeated exposure to heat sufficiently intense to ensure destruction of all cancer elements, not only in the parts directly treated, but probably for some distance beyond. We, therefore, not only remove large portions of the parametria but we try by repeated cauterization, for which Byrne so insistently pleads as the best safeguard against recurrence, to destroy the cancer elements in at least a part of the tissues remaining. The final steps of the operation, after thorough cleansing of the pelvic cavity and vagina, are the grasping of the bladder peritoneum anteriorly, and the peritoneum of Douglas' pouch posteriorly, and uniting the two surfaces by a few catgut sutures, thus closing the pelvic cavity, but leaving sufficient space on either side along the charred stumps of the parametria to insert an iodoform gauze drain which is left in place for about four or five days.

The remarkable feature in the convalescence of such cases is the freedom from pain. No other operation of similar moment is followed by so little discomfort. Werder has had sixteen cases; of these one died about four weeks after operation from uræmia, the result of renal disease; the operation may have hastened, but did not cause her death. He injured the bladder twice. A rectovaginal fistula resulted once. The ultimate fate of these injuries is not given.

Latzko[1] is a firm believer in the advanced radical operation and gives his technique in detail. Flatau[2] reports his work in Nürnberg. He used the advanced operation, and insists upon early diagnosis. Wallace employs a procedure very much like the original Werder operation.

[1] Zur abdominellen Operation des Gebärmutterkrebses, Wiener klin. Wochenschr., vol. xviii., Nr. 28.

[2] Erfahrungen mit dem Uteruskrebs in Nürnberg, Münch. med. Wochenschr., Bd. lii., Nr. 11.

[3] Experiences in the Treatment of the Cancerous Cervix Uteri by the Abdominal Route with Pelvic Dissection. Lancet, July 15, 1905, vol. clxix., No. 4272, p. 147.

The suggestion of Pfannenstiel to select the *vaginal* or *abdominal operation* for carcinoma from the particulars of the given case is a very rational one, provided it is once possible to distinguish absolutely between very malignant and less malignant forms. The vaginal hysterectomy of to-day is vastly superior to the operation of ten years ago. It is too early, says Wertheim, to express a final opinion on the procedure to which Schauta is devoting himself. At present, however, Wertheim would say:

1. The extensive vaginal operations are more difficult than extensive abdominal operations.

2. At present there is no difference in the mortality of the two operations.

3. In spite of all skill and technique the vaginal operation does not permit of so much of the parametrium being removed as does the abdominal.

4. The vaginal operation by no means permits of the removal of the glands which lie on the iliac vessels.

One of the commonest and most troublesome complications following an advanced abdominal operation for carcinoma is ureteral or vesical fistula. The bladder in most cases is more or less paralyzed after such an operation, and must be regularly emptied and irrigated. The bladder will usually recover itself as soon as the patient gets up or as soon as it becomes accustomed to the new intrapelvic relations.

Ureterovaginal or vesicovaginal fistula may appear immediately or a few days after operation.

Necrosis of the bladder occurred in twenty-two of Mackenrodt's cases. This, he thinks, was due to the participation of the bladder wall in the inflammatory processes about the cervix or to the presence of carcinoma itself. Fifteen times he found the bladder so fixed to the uterus under the vesicouterine plica that its separation was possible only with violence and with considerable loss of substance. In ten cases carcinoma was found in the bladder wall, and in four there was carcinoma in the connective tissue between the bladder and the uterus. Almost all the fistula heal spontaneously under the use of a permanent catheter and frequent irrigation. In respect to the ureter, he has forty-eight times enucleated it, on one or both sides, from an infiltrated broad ligament. Three times there has been necrosis. One of these fistula closed spontaneously. In the other two cases the ureter was implanted into the bladder. Excision of the ureters was done three times because, on account of dense embedment, it was impossible to separate the organ without serious injury of the ureteral wall. The cut upper end of the ureter was immediately transplanted into the bladder. One of these cases died from a recurrence; the other two are healthy, although in one of them there is a fistulous communication with the rectum.

Unexpected and accidental lesions occurred in the *ureters* on two occasions. Both times the ureter lay in the folds of Douglas and were cut through with these. Both were immediately transplanted; one case died, the other lives

Wertheim prefers nephrectomy in old cases of ureteral fistula to the reimplantation of the ureter into the bladder, because the fistulous ureter is embedded in a cicatrix and is difficult to release and to implant. The nephrectomy was very well borne in the three cases in which he used it.

Injury to the ureters or to the bladder is, of course, to be avoided whenever possible. The primary mortality attendant to such a lesion is not its entire mortality. If a fistula remain permanent, there is great danger of an ascending ureteral infection.

Koblanc[1] believes it good surgery, in case the bladder wall is actually involved in the carcinoma, to deliberately resect the diseased area, even though the carcinoma cannot be entirely removed from other parts. He contrasts this statement with one he makes in reference to the ureters, viz., that these should never be resected unless it appears that all of the carcinomatous tissue can be removed. The ureters are very rarely actually the seat of carcinomatous disease, whereas the bladder is rather frequently affected.

Thring[2] notes a case of ureterovaginal fistula following a radical carcinoma operation due, he believes, to trophic changes which followed ligation of the internal iliac artery in mistake for its anterior branch.

X-ray Treatment of Carcinoma. There are at present few enthusiasts in the treatment of uterine carcinoma by means of the *x*-ray. It is but necessary to quote from a few observers to give a correct impression of the present regard of the profession toward this agent.

Coley[3] concludes:

1. That the *x*-ray exerts a powerful influence upon cancer cells of all varieties, but most marked in cases of cutaneous cancer.

2. In some cases, chiefly in superficial epithelioma, the entire tumor may disappear, probably by reason of fatty degeneration of the tumor cells, with subsequent absorption.

3. In a much smaller number of cases of deep-seated tumor, chiefly cancer of the breast and glandular sarcoma, tumors have disappeared under prolonged *x*-ray treatment. In nearly every one of these cases,

[1] Die Beteiligung der Harnwege beim Uteruskarzinom und ihre operative Behandlung. Ein Beiträge zur Frage: Abdominal oder Vaginale uterus exstirpation, Zeit. f. Geburts. u. Gynäk., Bd. lv., S. 184.

[2] Carcinoma of the Uterus and its Surgical Treatment. Lancet, May 13, 1905, p. 1264.

[3] Final Results in the *x*-ray Treatment of Cancer Including Sarcoma. Annals of Surgery, August, 1905, vol. xlii., No. 2.

however, that has been carefully traced to a final result there has been a local or a general return of the disease within a few month to two years.

4. In view of this practically constant tendency to early recurrence, furthermore in the absence of any reported cases well beyond two years, the method should never be used except in inoperable cases, or as a prophylactic after operation as a possible, though not yet proven, means of avoiding recurrence.

5. The use of the x-ray as a preoperative measure in other than cutaneous cancer is contraindicated because (a) the agent has not yet been proven to be curative; (b) the danger of serious risks of an extension of the disease to inaccessible glands, or to other regions, by metastasis during the period required for a trial of the x-ray.

Vose and Howe[1] conclude:

1. That the only cure of cancer by the x-ray is by destruction and exfoliation. This at once limits its value to exfoliation.

2. That this destructive process is a slow one and acts very superficially. Since it is well known that many essentially chronic, superficial epidermoid cancers may be removed permanently by the slightest surgical procedure, that course seems preferable to the somewhat tedious treatment by x-ray, and as they both may fail, an extensive surgical operation, if necessary, may be undertaken more promptly in the former case.

3. That being non-selective in its action, the x-ray treatment cannot be used strongly enough to effect destruction of anything but the shallowest tumors without serious injury to the overlying and surrounding tissues, or in other words, producing such a burn as experience shows in all probability never would heal.

The Myometrium. The endometrium was formerly, and is at the present time, regarded very generally as the source of any atypical discharge from the uterus whether it be mucus, pus, or blood. Theilhaber and Meier, whose paper I reviewed in PROGRESSIVE MEDICINE, for June, 1904, drew attention to the fact that the musculature of the uterus, the myometrium, played a large part in the production of these symptoms. The lesion consists in an insufficiency of contractile power, so that the uterus becomes congested and the glandular activity of the endometrium and the normal menstrual flux increase or exhibit some other deviation from the normal. The endometrium itself does not at the present time receive the same consideration as a factor in the production of leucorrhœa and a typical hemorrhage that it once did. It is recognized now that the seat of a persistent discharge is often in the cervix and that an increased excretory activity of the endometrium proper may be due not only to

[1] The Effects of the Roentgen Ray upon Cancer. Journal of Medical Research, January, 1905, vol. xiii., No 2, p. 167

actual lesions of the endometrium but also to abnormal states of the uterine muscle. The latter is true also of increased menstrual flow and bleeding between the periods.

Attention may well be turned, in order to determine just what part the myometrium plays, to some recent investigations along this line. Kurdinowski[1] has made some very interesting experiments on the isolated uterus. His method is as follows: laparotomy is practised on a female rabbit under ether; the abdominal aorta having been tied just below the origin of the renal arteries a canula is introduced into the aorta. This canula is connected by an india-rubber tube with a vessel containing Locke's fluid at a temperature of 38° C. From this vessel the liquid passes at a moderate pressure through the aorta into the uterine bloodvessels, and thence flows away through a canula introduced into the inferior vena cava. After washing out the bloodvessels the uterus is extirpated, together with the adnexa the broad and the round ligaments, the intercellular tissues, a piece of the aorta, and one of the vena cava, and is put into the moist chamber of an apparatus especially constructed for this purpose. In this apparatus the uterus is nourished by Locke's fluid, and each contraction is recorded by a Ludwig kymograph.

For complete restoration of the uterus varying periods of time are required. Sometimes the organ, especially a gravid one, is "active" even after a few minutes, but usually half an hour to an hour is necessary for this to take place. The sensitiveness of the individual uterus varies: the gravid uterus is generally more sensitive than the non-gravid one; the former begins to act sooner, reacts much more distinctly, moves more energetically and more regularly. In favorable conditions of nourishment, temperature, moisture, and so on (the apparatus affords an opportunity of fulfilling all of these conditions with perfect accuracy) the uterus works, as it seems, without any external stimulus and in the following manner: The contractions of the uterus and those of the vagina are not as a rule simultaneous; they do not depend upon each other, and they recur at tolerably regular intervals. After an hour or more the uterus becomes fatigued, the waves of the curve become gradually less, the intervals between them become longer and at last the tracing forms a straight line; but after a short period of rest the uterus begins again to contract, and a certain regularity (rhythm) is to be observed in the work. Peristaltic contractions are best observed in the horns of the uterus. They are like the movements of the intestines or of earth-worms, and usually start from the abdominal end of the uterine horn. The other parts of the uterus, the ligaments and the Fallopian tubes, also show peristaltic contraction. The duration of life in the isolated uterus varies and depends upon several

[1] Physiology of Uterine Contraction. The Dublin Journal of Medical Science, vol. cxviii. p. 409.

conditions. After observations lasting for some hours, Kurdinowski took the uterus out of the apparatus and kept it in a cool vessel containing Locke's fluid. Under these conditions the uterus could be reviewed on the following day. After excision the uterus generally survived for twenty-four to forty-eight hours. In one case a gravid uterus lived forty-nine hours and forty minutes.

As a result of twenty-six physiological experiments the author concludes in part: The uterus at all stages of its sexual life is capable of automatic contractility. The virgin uterus in this respect shows no exception to the rule. The uterus reacts perfectly to thermal and to mechanical stimuli. Under their influence the uterine contractions increase and assume a more or less pronounced tetanic character. Under these circumstances true tetanus often occurs. Cold and warmth act with equal energy upon the uterus. The source of thermal stimuli appears to be not so much the absolute height of the temperature but rather variations of temperature independent of the direction of variation. To electrical stimuli the isolated uterus is relatively not very sensitive. In regard to the innervation of the uterus, it would appear from these experiments, says the author, that the uterus, at least as regards its contractile action, is to some extent independent of influences proceeding from the central nervous system. These experiments show what activity the uterine muscle exhibits more or less constantly without any connection with pregnancy or parturition. It follows, therefore, that a loss of contractile power in the uterine wall might easily result in a derangement of its circulation and produce a congestion of the endometrium, resulting in catarrh or menstrual disturbance. This is the view of Theilhaber,[1] who has recently reported the findings in a series of twelve uteri from patients the subjects of excessive hemorrhage. He found: 1, considerable enlargement; 2, widening of the bloodvessels; 3, increase of the connective tissue; 4, insufficiency of the uterine muscle; 5, dilatation of the uterine cavity.

In the majority of the cases which he observed at operation he found a stasis of blood in the veins of the broad ligament. According to him the contractions of the uterus are so weak in such cases that the venous blood is not properly squeezed out of the uterus. The most serious effect of insufficiency of the uterine muscle is metrorrhagia, because in this way the life of the patient may become seriously threatened. This symptom may be spoken of as myopathic metrorrhagia, and is the subject of a study by my colleague, Dr. Anspach,[2] of a number of such cases occurring in my clinic at the University Hospital. According to him *metrorrhagia myopathica* is a form of uterine hemorrhage which is

[1] Zur Lehre von der Entstehung der Uterusblutungen. Münch. med. Woch., lii., Nr. 26, S. 1249.

[2] Metrorrhagia Myopathica. American Journal of Obstetrics, January, 1906, p. 1.

independent of the usual causes of metrorrhagia,[1] and is produced by a pathological condition of the uterine muscle. This symptom usually manifests itself during the close of the childbearing period. At that time excessive menstrual flow or uterine hemorrhage between the periods, in the absence of the accepted causes of this abnormality, is often hard to explain. If, in a given case, there is no new growth of any kind; if pregnancy can be excluded; if there are no adnexal, visceral, or general complications; if, in short, none of the usual causes of metrorrhagia obtain, the condition is, as a rule, regarded as obscure and variously consigned to apoplexia uteri, endometritis senilis, preclimacteric bleeding, etc. These terms are often loosely applied.

Apoplexia uteri presupposes arteriosclerotic changes in the uterine arteries, with an actual rupture of one of these unhealthy vessels. What role arteriosclerosis of the uterine vessels plays in uterine hemorrhage is yet to be decided. Reinecke says that it alone cannot account for persistent metrorrhagia, and notes cases in which there was no metrorrhagia and yet the vessels showed arteriosclerotic changes. The author concludes from his own cases that arteriosclerosis in the uterus has not the significance it takes elsewhere. In the uterus, *arteriosclerosis* is the result of the development and subsequent involution of the bloodvessels, indelibly associated with pregnancy and the puerperium. It occurs normally in every parous uterus, and may have no more pathological import than has the general arteriosclerosis of the aged.

Endometritis senilis is another term under which these myopathic metrorrhagia cases are grouped. Dunning has recently written extensively upon this subject. In Dunning's cases there was hypertrophy of the mucosa, arteriosclerotic changes in the bloodvessels, and a disseminated myxomatous degeneration of the muscularis. None of these conditions warrants the title endometritis senilis. There is no lesion of the endometrium characteristic of age but atrophy, and this is normal. There is as much propriety in speaking of endometritis adolescens as of endometritis senilis, for endometritis may occur at any age, and such terms convey no suggestion of the actual morphological condition. As will be shown later, arteriosclerotic changes occur in every parous uterus. The mucoid degeneration reported by Dunning might have considerable import, if it were found constantly in metrorrhagia cases of this sort. At any rate,

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[1] The usual causes of menorrhagia or metrorrhagia are given by Jakesch as follows:

Local.—Endometritis chronica fungosa, polyp, fibromyoma, ovarian tumor (while small).

General.—Chronic nephritis, heart disease, cirrhosis of liver, typhoid, cholera, variola, scarlatina, influenza, acute articular rheumatism, hæmophilia, scurvy, syphilis (secondary and tertiary), chlorosis.

To these may be added carcinoma, sarcoma, adenomyoma, pregnancy, cystic endometritis.

the symptoms in Dunning's cases were due either to cystic glandular endometritis or to some disease of the muscularis; in either event endometritis senilis is an inappropriate title.

Preclimacteric bleeding is a specious name given to cases of metrorrhagia myopathica, which conveys no meaning, but the period of life at which the hemorrhage occurs. It is plain from the existence of these terms that there is a class of cases which are not very well understood, and are conveniently but falsely classified. They may be spoken of as cases of metrorrhagia myopathica, with the view that the cause lies in the uterine muscle, whether it be an actual primary disease of the part itself or a secondary lesion the result of a general condition.

What is the nature of the pathological process in the wall of the uterus? Arteriosclerosis of the uterine vessels was, in the past, considered to be a sufficient cause. At the present time this view is not generally accepted. Theilhaber and Meir believe that a fibrosis of the uterine musculature leads to metrorrhagia; in other words, from a disproportion between its muscular and its connective tissue constituents the uterus loses its contractile power, and this results in congestion and hemorrhage. Several years ago Pick published a paper in which he described minutely the elastic fibres of the uterine muscle and of the uterine bloodvessels. He found that the elastic tissue varies in its amount and in its form at different periods of life and in different diseases.

It occurred to Anspach that as this tissue played such a large part in the pathology of arteriosclerosis and of the vascular system in general, it would be worth while to investigate the elastic tissue in the uteri of women, the subjects of metrorrhagia myopathica. He studied the elastica in twenty uteri taken from women at different periods of life and compared them with three clinical cases of metrorrhagia myopathica which occurred in my clinic.

Histology of the Uterus. In order to make a description of the elastica plain it will be necessary to state that according to Kreitzer there are four layers of muscle in the uterine wall. There is first the layer containing the large bloodvessels, spoken of as the *stratum vasculare*, which occupies the largest part of the myometrium; running between this and the mucosa there is a layer whose general direction is longitudinal, spoken of as the *stratum submucosum;* an outer layer, running longitudinally directly under the serous coat is given the name *stratum subserosum;* the irregular fibres between the latter stratum and the vascular layer are known as the *stratum supravasculare.* The elastic tissue of the uterus is derived from two main sources: first, the serous coat; second, the bloodvessels. In the subserous and in the supravascular layers the elastic fibres are very rich. They surround the individual muscle cells in the outer layer forming elastic perimysia. They are not subdivided to this extent in the supra-

vascular layer. Their general direction is toward the endometrium, and as the outer muscular layer is longitudinal, and the supravascular is more or less circular, they run at right angles to these muscle bundles. In the vascular layer the elastica is mostly confined to the vascular channels; in the submucosa there is practically no elastica except in the vessels. The elastic tissue of the subserous and supravascular layers appears as fine, unbroken fibres of a more or less uniform thickness. Many of them are quite straight, especially those taking a centripetal course. In the vascular layer elastic tissue is found surrounding the lymph spaces and capillaries and the veins and the arteries of all sizes. About lymph spaces they appear as short, wavy fibres, or as small black points. Their distribution is quite irregular and the number always small. This is true also of the capillaries. In the veins there is a collection of elastic tissue between the inner and the outer coat. It is quite irregular and forms no distinct limiting band as in the arteries. In the small and medium-size arteries there is a distinct limiting membrane of elastic tissue between the intima, the media and the internal elastic membrane; and between the media and the adventitia in the larger vessels is another, the external elastic membrane. Pick draws attention to the arrangement of elastic tissue in the uterus as being highly significant. The preponderance of the fibrils in the subserous and the supravascular layers, their definite direction (centripetal) toward the endometrial cavity, their fine subdivision so that in the outer layer they surround each individual muscle cell, all of this he believes shows that they have a very well-defined purpose. They serve not only for the support of the blood and lymph capillaries and the nerves, but further than this, they reinforce the muscular action of the uterus, protect it from being overstretched, and make easier its return to a passive state after either distention or contraction.

There are very striking changes in the elastic tissue as the result of pregnancy, and the greater the number of pregnancies the greater as a rule are these changes. It is quite easy to say from a section of the muscle of the uterus stained by resorcin-fuchsin stain whether the woman has had children or not. The alterations of the elastica effect not only that in the two outer layers of the myometrium but also that in the vascular channels. The elastic tissue in the subserous and in the supravascular coat becomes increased in amount and the fibres are shorter, thicker, show a tendency to become clumped together, and are curly rather than straight. In the vessels wherever elastic tissue is present normally the amount is very much increased the fibres showing the same tendency to become broken, thick, and gathered into clumps. The vessel changes which were observed in these cases may be spoken of as intramural and perivascular. The intramural changes in the arteries consist of a broadening and a splitting of the internal elastic membrane. It no longer consists of a fine, single

line but is irregular and three or four times its normal thickness. The elastica of the veins in this form is similarly increased. Another form of elastic hypertrophy, the perivascular, occurs in the adventitia. The entire adventitia is represented by heavy masses of elastic tissue in which no small fibrils are seen—the tissue appears a dense black. In sections stained by Van Gieson's stain these same areas appear bright yellow, and with hæmatoxylin and eosin they are granular pink, and contain scatt red, well-preserved nuclei. The internal elastic membrane in such cases may be fairly normal. This degeneration, perivascular, increases in some cases until it occupies the entire wall of the artery. Such a vessel is bright yellow by Van Gieson's stain and of a granular pink color by eosin and hæmatoxylin, while densely black with Weigert's stain. The same dense deposit of elastic tissue occurs in the outer coat of the larger veins. These areas here appear bright yellow by Van Gieson's stain and pinkish granular by hæmatoxylin and eosin.

The finer *physiology of the uterus* embraces the changes incident to puberty, menstruation, childbirth, the puerperium, and the menopause. Physiologically the female generative organs, especially the uterus and the ovaries, are peculiar in that they develop activity later than any other organ of the body, dominate in a measure all other organs for a while, and then cease their activty at a time considerably before the effects of age are noted in other parts. The changes incident to the various periods in normal uterine activity are appreciable through anatomical alterations and these affect the several constituents of the uterine wall, which have already been described.

Before the age of puberty the uterus is functionless. At puberty there begins a development of the uterine muscle. While up to that time, according to Theilhaber and Meir, but one-third of the uterine bulk is muscular tissue, the latter increases rapidly to puberty, and up to the age of twenty, when the muscular elements constitute fully two-thirds of the entire bulk. There is a similar increase in elastic elements and in the vascular supply, which brings the anatomy of the uterus up to that already given of the healthy nulliparous uterus during the childbearing period. During pregnancy all of the structures of the uterine wall undergo hypertrophy. The elastic fibres, together with the other uterine tissues, increase up to the fourth month. During the latter part of pregnancy the elastic tissue diminishes, but this diminution is more apparent than real, and results from the stretching of the uterine wall.

The elastic fibres, however, increase considerably in the paracervical tissue during pregnancy, and this, it has been assumed, is a provision of nature for the dilatation of the lower uterine segment during labor. During the puerperium, when all of the hypertrophied and hyperplastic elements of the uterus undergo involution, there is an actual increase in

the number of fibres, which is sufficient to brand the parous from the nulliparous uterus. Theilhaber and Meir assert the same of the connective tissue –viz., that while after pregnancy the entire uterus undergoes involution, this affects the muscular more than the connective tissue elements and results in an increase of the latter at the expense of the former.

After the menopause the uterine vessels become diminished in calibre from a thickening of their walls; the vessels show more or less arteriosclerotic changes and have a tendency to approach one another to form groups. There is a great increase of elastic tissue about these groups, but the elastic fibres are mostly isolated in this position and the islands of degenerating vessels and elastic tissue scarcely communicate with one another, so that aside from the vascular islands there is little elastic tissue in the vascular layer. In the external layers of the uterus there is also a considerable increase of the elastic tissue. This change in the proportion of elastic tissue of the uterine wall is compared by Melnikow-Raswendenkow to similar changes occurring in parenchymatous organs, *e. g.*, in the kidney, liver, heart, spleen, etc., as the result of age. *He believes that the elastica takes the place of atrophied parenchyma, be it epithelial or muscular, and furthers the mechanical internal equilibrium of the organ. Wherever, he says, by the atrophy of parenchymatous structures there is a disturbance in the dynamics of secretion and excretion the vis a tergo is supplied by the new-formed elastic tissue.*

That this preservation of uterine tone is necessary during menstrual life and that the increase of elastic tissue which accompanies the diminution of the muscle elements is a provision of nature cannot be doubted. The contractile power of the uterus plays an important part in the phenomena of menstruation as it does in any hemorrhage from the uterus. The powerful influence which uterine contraction has upon hemorrhage from the uterine interior is seen at the close of labor. In normal menstruation the endometrium plays a passive part. There is no actual rupture of the endometrial vessels, but a diapedesis of the menstrual fluid through the thin-walled capillaries of the subepithelial capillary network. The fluid accumulates beneath the epithelium of the endometrium and gradually finds an exit between the epithelial cells or through breaches in the epithelial layer. As this is almost entirely a passive process it follows that the quantity of the menstrual flow is in direct relation to the blood pressure within the endometrial capillaries. The endometrial blood pressure in turn depends upon the force of the arterial supply and the calibre of the venous channels of return. As the arteries have firmer and better defined walls than the veins they are, therefore, less compressible, and the slight contractions of the uterus which occur at the menstrual periods narrow the venous but have little influence upon the arterial chan-

nels. In this way there is a sufficient disproportion between the inward and the outward flow to produce congestion of the endometrial vessels and a resulting diapedesis. This is entirely in accord with my own conclusions, for I have found that unless a myoma actually encroaches upon and erodes the mucosa the hemorrhage attending these tumors is due entirely to disturbances in the return circulation.

It is natural, then, at the close of menstrual life that the muscular elements having no further use should undergo atrophy and that the intravascular area of the organ should be diminished by sclerotic changes in the bloodvessel walls, and that this should be furthered, as it is in other organs, by an increase of elastic tissue which helps contract the vessels and takes the place of lost parenchyma. It is easy to see, therefore, that a failure in the normal increase of elastic tissue or a failure in the normal obliterative changes of the vascular channels, or an excessive atrophy of the muscular elements, or an excessive hypertrophy of connective tissue (making firm contraction of the uterus and compression of the bloodvessels more or less faulty), might result in disturbances of the endometrial circulation and produce profuse menorrhagia or metrorrhagia.

From his own observations Anspach concludes that the alterations which he observed in the elastic tissue were the result of pregnancy. They did not appear to depend on age, for in two nulliparæ aged thirty-seven years there were none, and in a primapara aged forty-one years the changes were but slight.

These changes in the uterine vessels which are roughly spoken of as arteriosclerosis invariably occur as a result of pregnancy and must be considered normal. They are much more constant and notable than the increase in the relative proportion of fibrous tissue which often follows pregnancy and which was not found to be constant or so marked as was noted by Theilhaber.

Pathological Anatomy of Metrorrhagia Myopathica. The anatomical changes in these cases were not constant. In the first two cases the amount of elastic tissue and the vascular changes were not proportionate to the parity of the uteri. Thus the first case had ten children and three miscarriages and yet the changes in the elastic tissue in the vessels were not as pronounced as would be expected. In the second case, two children and one miscarriage, there was scarcely more alteration than is usually found in a primipara. The fibrous tissue was disproportionately increased in the second case. In the first there was not as much as would be expected from the parity of the individual. In the third case the amount corresponded to the history of the uterus.

From the first two cases it might be said that a failure of the normal increase in elastic tissue had resulted in an insufficient contractility of the uterus and a resulting congestion and hemorrhage. Pick records a

case of a woman, aged sixty-three years, who had metrorrhagia which resisted all means of treatment. Hysterectomy (vaginal) was performed. " Outside of the somewhat arteriosclerotic vessels there was no mentionable increase of elastic tissue." From these three cases it might be inferred that a failure in the development of elastica was the essential lesion in metrorrhagia myopathica. The last case in the series, however, forbids any such conclusions at this time. To settle the question it will be necessary to study additional cases, determining first whether they actually belong under the head of metrorrhagia myopathica, excluding all of the well-known causes, general and local, before they are so classified. None of the commoner forms of degeneration were present in the musculature of these cases, so that the myxoid degeneration found by Dunning in his series cannot be regarded as constant. Œdema was present a number of times, but as it must be regarded as the result of congestion it was not recorded. It did not occur in either of the three myopathic cases.

Anspach concludes:

1. Metrorrhagia myopathica stands for a *distinct class of cases*, which have heretofore been variously and incorrectly grouped under apoplexia uteri, endometritis senilis, and preclimacteric bleeding.

2. Metrorrhagia myopathica is a symptom immediately dependent upon an anatomical or a physiological lesion of the uterine muscle.

3. No anatomical lesion has as yet been demonstrated, but it will probably be found in the elastic tissue constituents of the vessel walls and the subserous and supravascular layers.

4. The physiological lesion is most likely an insufficient contractile power of the uterus. It is possible that the condition is purely functional and that there is no anatomical change which can be recognized.

5. In cases of metrorrhagia myopathica the uterus is enlarged and softened; the os is patulous.

6. Metrorrhagia myopathica does not occur in nulliparous women and therefore it must have some connection with the childbearing process.

7. The diagnosis of metrorrhagia myopathica is only justifiable when all other possible causes for uterine hemorrhage have been excluded. *This cannot be too strongly urged in reference to carcinoma.*

8. The terms apoplexia uteri, senile endometritis, and preclimacteric bleeding as applied to these cases are incorrect and unscientific.

9. While curettement, atmocausis, etc., have little effect in cases of metrorrhagia myopathica, palliative measures should always be tried before adopting hysterectomy.

10. Obliteration of the endometrial cavity by means of destructive atmocausis is the alternative of hysterectomy in these cases. It is, however, harder to perform correctly and more dangerous than hysterectomy, which is the operation of choice.

The palliative treatment of obstinate cases of metrorrhagia is often most unsatisfactory. The rational plan will always bear in mind the cause if that is discoverable. Thus Cumston[1] advises, in cases of *metrorrhagia, associated with circulatory diseases and high arterial tension*, rest in bed, a dry diet, and the use of arterial sedatives. The lowering of the blood pressure in this way he says often acts beneficially.

Queisner[2] speaks of what he calls "climacteric bleeding." He notes the failure of an apparent reason in many cases and the failure of any therapeusis except extirpation. He has had good results and suggests the novel plan of splitting the anterior wall of the uterus and thoroughly cauterizing the interior of the uterus.

The therapeusis of myopathic cases is helped by the observations of Kurdinowski on the basis of sixty pharmacological experiments. These experiments on the isolated uterus have the advantage over experiments on the intact animal that, in the case of the isolated organ, separated as it is from any connection with the central nervous system, it is easier to explain the manner and mode in which uterine remedies produce their effects, and to differentiate between the way in which the local peripheral effects and those centrally produced are respectively brought about Hydrastinin, sphacelinic acid, and ergot act directly on the uterine muscle and cause contractions of the uterus; the action on the vasomotor apparatus of these drugs in the uterus or elsewhere is independent of this action and is central. *Adrenalin*, even in the most dilute solutions, acts more energetically upon the uterus than those remedies which are regarded as specific for that organ. It evokes a violent reaction, greatly strengthening the uterine contractions and imparting to them a very pronounced tetanic character, while at the same time it increases, more than other poisons, the excitability of the uterus.

Steinschneider[3] has used adrenalin chloride with great success in three cases of metrorrhagia. He applied it locally to the uterine interior by means of an applicator or in the form of a gauze pack.

Cotarnine hydrochloride or *stypticin*, says Boldt,[4] is a fractionation product of the oxidation of narcotine, an alkaloid obtained from opium, and is a microcrystalline yellow powder soluble in water. It has an intensely bitter taste. The author has used the drug in the following cases of uterine bleeding with the indicated results:

[1] Metrorrhagia in Interstitial Nephritis. Buffalo Medical Journal, June, 1905, vol. xliv., No. 11, p. 718.

[2] Zur Behandlung der klimakterischers Blutungen. Zent. f. Gynäk., 1904, xxviii., Nr. 51.

[3] Adrenalin bei Gebärmutterblutungen. Münch. med. Woch., lii., Nr. 2, S. 72.

[4] Cotarnine Hydrochloride in Uterine Bleeding. New York Medical Journal and Philadelphia Medical Journal, February 25, 1905.

Fibroid tumor of the uterus. Thirty-five cases, eleven were more or less benefited; twenty-four were not benefited at all. Its uselessness was most marked in instances of submucous tumors.

Hemorrhage from uterine cancer. Nine cases, none successful. Postpuerperal bleeding after removal of retained placenta particles and decidua five cases; all cured.

Hyperplastic endometritis. Thirteen cases, three cases benefited. In glandular endometritis, all negative.

Retroversioflexion and endometritis. Five cases, one case only relieved, menorrhagia. Drug given: 1-grain doses two days before expected period. As soon as flow began 2.5 grains were ordered every three hours.

Chronic metroendometritis. Nine cases, five more or less benefited, four negative.

Various forms of non-suppurative pelvic inflammation, the uterus itself not being markedly affected. Twenty-three cases: cured in eight; improved in nine; slight improvement in three; negative in three.

Bleeding during pregnancy. Eleven cases, all stopped, no bad symptoms.

Profuse menstruation in virgins, without detectable changes being found in pelvic organs on rectoabdominal examination. Seventeen cases, in only five entirely negative results.

Atypical bleeding during the climacterium. Result fairly satisfactory in cases where no cause at all could be found for the hemorrhage.

The author says it must not be expected that cotarnine hydrochloride (stypticin) is a panacea for all cases of uterine bleeding, but it has been found to answer better than any other remedy he has used. If no effect at all is produced after three large doses (from 2.5 to 5 grains) have been given it is useless to continue with the drug. It is likewise not recommended to continue its use in instances of fibroid if two hypodermic injections of 5 grains each, at intervals of four to twelve hours, do not cause a diminution of the hemorrhage. In the cases of menorrhagia the best plan is to begin with a 1-grain dose, three times daily for about a week before the expected flow, and as soon as the flow begins 2.5 grains every three hours, to be continued throughout the entire period. In instances of metrorrhagia 2.5 to 5-grain doses may be given at intervals of from two to three hours until the bleeding is lessened, then the dose may be decreased from 1 grain to 2.5 grains at intervals of three to four hours. If a quick result is important it is best to give 3 to 5 grains in a 10 per cent. solution simultaneously into the buttocks, using the customary antiseptic precautions. Because of its disagreeable taste it should be put in capsules.

DYSMENORRHŒA is a perennial subject of discussion. The treatment of this symptom is so often unsatisfactory and it is so frequently regarded

as a disease rather than as the manifestation of a disease that any light upon it is of value. Kelly[1] has drawn attention to the fact that cases are frequently spoken of as instances of dysmenorrhœa and the symptom alone is treated, when the real cause of the trouble (small fibroid, etc.) is not discovered. In a general way dysmenorrhœa is found in three sorts of cases: first, those in which there are recognized gross lesions to account for it; where it has no more significance than any other symptom; second, obstruction of the cervical canal in which the menstrual pain results from some hindrance to the outflow of the monthly flux; third, those cases in which an anatomical lesion is difficult to find. The latter are the cases referred to by Coe[2] in a late paper. He says there is a distinct tendency on the part of thoughtful observers to recognize general causes of local symptoms and to direct treatment accordingly. He draws attention to dysmenorrhœa as an example. In many neurotic women, both single and married, dysmenorrhœa is not due to a disease of the uterus or of the ovaries, but to an exaggeration of the normal physiological contractions of the uterine muscle, which occur at the menstrual period. In a neurotic or hysterical subject these contractions may become so excessive as to give rise to more or less severe pains, which are most marked, says Coe, if they assume the form of tetanic contractions of the sphincter at the os internum. From this it follows that it is exceedingly fallacious to conclude that because an otherwise healthy uterus is slightly more anteflexed than normal, that dysmenorrhœa is due to obstruction of the flow and that dilatation will produce a cure. The author reports the work of Rosner, who concludes that intermenstrual pain is really a pelvic neuralgia, without demonstrable lesions, most common in arthritic subjects, due to some abnormal action of the ovaries.

Although the various types of dysmenorrhœa may be distinctly defined it does not follow that they are always clinically differentiable. Thus there may be a combination of the nervous with the obstructive or of the nervous with the secondary type. The nervous element in dysmenorrhœa is always the difficult element to estimate and to treat. One should not make a diagnosis of nervous dysmenorrhœa until every possible gross cause has been looked for without result.

Ovarian dysmenorrhœa is a name which has been confused with nervous dysmenorrhœa. Dysmenorrhœa may be due to diseases of the ovary and then in a sense may be regarded as ovarian. It should be spoken of in such cases as dysmenorrhœa secondary to ovarian disease. Occasionally in dysmenorrhœa, although the ovaries appear

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[1] Dysmenorrhœa: Its Causes and Treatment. American Journal of Obstetrics, 1894, vol. xxix. p. 502.

[2] The Surgical Treatment of Menstrual Disorders. New York Medical Journal and Philadelphia Medical Journal, vol. lxxxiii., No. 1, p. 44.

normal or at least no more than slightly enlarged upon bimanual examination, when exposed they are seen to possess a more or less thickened tunica albuginea. This is a rational explanation for dysmenorrhœal pain when one considers the difficulties under such circumstances with which the Graafian follicle breaks through the ovarian capsule. These are the cases evidently referred to by Eitel[1] as ovarian dysmenorrhœa. He says it occurs most often between the ages of sixteen and forty. The history in most of the cases is that the periodical suffering began a year or two after menstruation became established, increasing in severity from year to year in spite of treatment. Persons who suffer from "ovarian dysmenorrhœa" usually have done a great deal of worrying during the years of their physical development. All cases in the married which Eitel has seen occurred in women who had never been pregnant. The ovaries in these cases have thickened capsules and are cystic. For four years Eitel has been removing the capsules of such ovaries from the hilus to the cortex. He reports good results. There is no danger from adhesions. If the peritoneum is not affected the raw surfaces do not adhere. The ovary is always suspended in addition by means of the utero-ovarian ligament.

A very good paper on dysmenorrhœa has been written by Holden,[2] who has made a statistical study of the cases at the Johns Hopkins Hospital. The author concludes:

1. Dysmenorrhœa may be primary or secondary. In primary dysmenorrhœa the pelvic organs are either normal or else merely poorly developed. In secondary dysmenorrhœa marked pathological changes are present in the pelvic organs, and these pathological changes are the cause of the dysmenorrhœa. The most frequent conditions causing dysmenorrhœa are: (*a*) pelvic inflammatory disease; (*b*) retrodisplacement of the uterus; (*c*) myomata especially of the submucous variety.

2. Primary dysmenorrhœa often dates from debilitating illnesses, and is often apparently caused by anæmia, malnutrition, and neurasthenia.

3. In 40 per cent. of all cases of dysmenorrhœa in which the pelvic organs are normal, or else merely poorly developed, successful results may be expected from dilatation of the cervix and curettement of the endometrium. By "successful results" is meant entire or very great relief from dysmenorrhœa for a year or more with or without subsequent return of the trouble. No relief whatsoever may be expected in 30 per cent. of the cases. Relief of the remaining 30 per cent. varies in degree and duration.

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[1] Removal of the Covering of the Ovaries in Ovarian Dysmenorrhœa; a Preliminary Study. Northwestern Lancet, Minneapolis, January 15, 1905, vol. xxv., No. 1, p. 5.

[2] Dilatation and Curettement for Dysmenorrhœa. Report of Ninety-five Cases. American Medicine, November 4, 1905, vol. x., No. 19, p. 776.

4. The presence of anæmia, malnutrition, or neurasthenia does not necessarily cause a bad prognosis after dilatation and curettement, but in order to obtain a successful result from the operation, these conditions must be rectified. If the patient's general condition is not improved, little relief will be given by the operation.

5. The prognosis is better in those cases in which the pains begin the day of the flow or the day before, are sharp in character, and last but a day or two. The prognosis is worse when the pains begin several days before the flow appears, are dull in character, and last for several days or throughout the flow.

6. Every operation should be preceded by a careful examination under ether. If the organs are not normal the prognosis is worse. When the history points to inflammatory trouble, even though none can be recognized at the ether examination, its possible existence should be carefully considered. If in such cases an exploratory laparotomy is not thought advisable, it is best to limit operative procedures to dilatation of the cervix and omit curettement.

7. In dysmenorrhœa recurring after a period of relief following dilatation and curettement the possibility of the new appearance of a pathological condition in the pelvis, *e. g.*, a retrodisplacement, should be carefully considered.

8. When the pelvic organs are poorly developed the prognosis for relief after dilatation and curettement is much worse than when the organs are normally developed. Apparently maldevelopment of the pelvic organs causes dysmenorrhœa.

9. Chronic endometritis is rarely present in cases of dysmenorrhœa unless there is at the same time an inflammatory condition of the tubes or of the ovaries. Chronic endometritis alone is rarely a cause of dysmenorrhœa.

10. Sterility is relieved by dilatation and curettement in but 15 per cent. of the cases of sterile married women who are in the childbearing period. The relief of dysmenorrhœa does not necessarily mean the relief of the sterility, and vice versa, sterility may apparently be relieved without relief of the dysmenorrhœa. The relationship between dysmenorrhœa and sterility seems an accidental one and of no significance.

11. While dilatation and curettement in the majority of cases is perfectly safe, still when the technique of the operator is imperfect, either on account of unfavorable surroundings or lack of proper skill, it may be exceedingly dangerous.

AMENORRHŒA AND SYSTEMIC DISEASE. It is usually considered, says an editorial in the *Journal of the American Medical Association*,[1] that amenor-

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[1] Amenorrhœa and Systemic Diseases. Journal of the American Medical Association, vol. xliv., No. 23, p. 1859.

rhœa, especially if it asserts itself after menstruation has once been thoroughly established, is due to some affection of the genital tract. As a matter of fact, however, the cessation is more likely to be the consequence of some systemic disease. The cessation of the menses in young women may be the first sign of *tuberculosis*, where there is otherwise little disturbance of the health. As a matter of fact menstruation and the menstrual period in women present conditions, modifications of which in various ways point more often to an active tuberculous process in the system than almost any other set of symptoms. Recently it has been stated that *chlorosis* is reported much less frequently than used to be the case, and there would seem to be a lessening of the prevalence of this blood affection in America. It has been suggested, however, that the apparent diminution of chlorosis is really due to the earlier recognition of tuberculosis than formerly. The two affections present a similar blood picture at the beginning, and the treatment, fresh air, and abundant diet, with care of the bowels is the same for both. It is more favorable to find tuberculo is present than severe chlorosis, since genuine cases of chlorosis are likely to be associated with defects in the blood-making organs, or with abnormally small size of the heart and arteries, conditions which are hop less. Certain nutritional disturbances consequent on a marked change in the habits of life of the individual are often followed by a cessation of the menses. This is especially true when young women move from the country into the city, and as a consequence have much less outdoor air than before, and usually, also, much less nutritious food. In most immigrant women there is a period during the first year after their arrival in America during which their menses are irregular if not entirely absent. This, too, would seem to be a result of the disturbance of the blood-making function consequent upon a lessened amount of fresh air. Sir Andrew Clarke used to insist, however, that chlorotic conditions associated with amenorrhœa are more often the result of chronic constipation or of insufficient evacuation of the bowels—two quite distinct conditions—than of any other single cause. Certain it is that most of the country girls who come to the city as well as most of the foreigners who come to this country are apt to suffer for a time from irregularity of the bowels, and treatment for this symptom does more to bring about a return to their normal conditions than any more direct remedial measures that may be considered indicated for the menstrual disturbance.

In quite recent years it has come to be realized that many of the serious nervous affections have amenorrhœa as one of their preliminary or very early symptoms. This is especially true of affections of the *ductless glands*. When there is lack of the thyroid substance in the system, as occurs during myxœdema, amenorrhœa is usually a symptom. In a few cases of exophthalmic goitre, associated with a distinct tendency to obesity during the

years between fifteen and twenty, menstruation is often scanty or absent. As a rule, during the course of exophthalmic goitre, however, there is an increase in the menstrual flow. It is said that the cases marked by amenorrhœa are usually amenable to treatment by thyroid extract. The first symptom of Addison's disease in young women is likely to be a suppression of menstruation. The lowered blood pressure consequent upon the absence of the internal secretion of the suprarenal bodies somehow affects the function of the uterine mucosa so as to prevent the usual hemorrhagic exudation. The disturbance of the function of the pituitary body associated with the enlargement of the face and of the extremities, that eventually gives the clinica' picture of acromegaly, is likely to have as one of its first symptoms the absence of menstruation. This occurs at a time when there are but very few signs of the disease which is developing. A certain amount of coarsening of the features may have been noticed, but even friends are not likely to consider this as evidence of a pathological condition. Sometimes the menses are absent for several months before any pathognomonic signs of the serious nervous disease can be recognized. Amenorrhœa associated with severe headaches, for which treatment is of little avail, especially if there is also some disturbance of vision, or if there is vomiting, without cause, must be considered suspicious; and if the features of the patient are heavier than normal, then the development of a tumor of the hypo hysis must be considered as one of the possibilities in the case.

Uterine Muscle during Curettage. PARALYSIS OF THE UTERINE MUSCLE DURING CURETTAGE. Van Tussenbroek[1] calls attention to the relaxation of the uterine muscle, which occasionally takes place during intrauterine instrumental manipulation. Van der Mey, eleven years ago, called attention to this phenomenon. He frequently found that a sound would pass 2 cm. farther into the uterus after a curettage than it did before. Such an occurrence is taken by most of the authors of text-books as an indication of perforation of the uterine wall and almost nothing is said of relaxation or paralysis of the non-pregnant uterus during dilatation and curettage. The author has found that quite regularly, in the performance of this operation, upon first introducing the curette into the uterine interior there is some relaxation of the organ, but that after two or three strokes this disappears and the uterus contracts firmly. The sound which is heard during curettage, spoken of by the French as the "cri uterin," is attributed by Trueb to the contact between the curette and the muscle. According to Trueb it occurs as soon as the mucosa has been scraped away and the instrument impinges directly upon the myometrium. Van Tussenbroek thinks it occurs as soon as the primary relaxation of the uterine

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[1] Ueber wechselnden Tonus des Gebärmuttermuskels mit Bezug auf die Gefahr einer Perforation bei der Curettage. Zent. f. Gynäk., 1905, Nr. 34, S. 1054.

muscle gives place to contraction. When the relaxation is more marked the condition may be spoken of as a paralysis of the non-pregnant uterus. The uterus becomes a large, loose, wide sac, the walls of which recede from the curette. The sudden recurrence of this condition during curettage is most alarming to the operator, unless he is aware of this possibility, and he will be certain to believe he has produced a perforation. Very often if he stops for a few minutes and then proceeds cautiously, the uterus will contract and give no further trouble.

Strassmann has criticized the belief of Kossmann in paralysis of the non-pregnant uterus; he believes much harm will come because in most of such alleged cases perforation has occurred. The author presents a number of facts to sustain the theoretical possibility of this relaxation and paralysis of the non-pregnant uterine muscle. Keiffer's experiments, bimanual examination, everything points to a more or less periodic physiological variation in the tone of the myometrium. Keiffer found that not only contraction but also dilatation could be produced by certain forms of irritation. Thus central irritation of the divided crural nerve caused dilatation of the uterus, and total paralysis occurred after destruction of the lumbar cord and in acute anæmia. Van Tussenbroek thinks that paralysis of the myometrium may, to a certain extent, be the result of dilatation of the cervix. She speaks of the relaxation following overstretching of the sphincter ani and thinks the operation on the cervical sphincter may have an associated effect upon the muscle of the corpus. The actual truth will be shown by careful measurements of the uterine cavity before and after dilatation and before and after curettage. She reports the observations made upon her last four cases of curettage.

No. 3756. Frau K., virgin, aged twenty-six years, dysmenorrhœa, uterus sharply anteflexed. Dilatation with laminaria tent three times for twenty-four hours. March 31st, narcosis; uterine cavity, 7.3 cm. After dilating the cervix further with Mathieu's dilators, the uterine cavity measured fully 9 cm., and remained so throughout the curettage. Relaxation of the uterine wall was evident but not excessive. A moderate amount of curettings were removed. Eight days later the length of the uterine cavity was 8 cm.

No. 3778. Frau K., nullipara, aged forty-eight years, irregular hemorrhage, uterus in anteflexion. Dilatation with laminaria tent for twenty-four hours. March 31st, narcosis; uterine cavity 10 cm. long. After further dilatation (Mathieu), 10 cm. During and after curettage 10.5 cm. Anterior wall relaxed during operation. After irrigation it contracted again and grated under the curette.

No. 3841. Frau E., primipara, aged thirty-one years, hemorrhage for four weeks after two to three months' abortion. Uterus in retro and dextro positions, somewhat difficult to estimate bimanually, but apparently not

much enlarged and not soft. May 4th, narcosis; sound, 9 cm. During and after curettage, 10.5 cm. Not a typical case. The "cri uterin" was audible from the very beginning of the operation. Much tissue was removed by the curette. Six days after curettage the sound entered 9 cm.

No. 3792. Frau B., III-para, one abortion, aged thirty-nine years, irregular metrorrhagia, nearly permanent, but differing in degree from March 25th to May 10th. Last normal period about March 1st. Suspicion of an early abortion. Uterus tolerably large, not soft; brown, decomposed blood in the vagina and the portio congested. Laminaria dilatation for twenty-four hours. Narcosis May 12th. Sound, 9 cm. After dilatation (Mathieu) sound entered 10.5 cm. During curettage the uterus relaxed more and more, 13 to 15 cm. Consistency and depth of the uterus continually changing. During irrigation the tone of the organ was regained. The cavity was washed out with ichthyol and drained with iodoform gauze. No reaction followed curettage. The mucosa showed no indication of abortion.

ACCIDENTAL PERFORATION OF THE UTERUS. Hessert[1] believes the so-called cases of paralysis of the uterine muscle and dilatation of the uterine cavity during curettage are more likely to be cases of perforation. The Fallopian tubes in a normal subject, he thinks, could not be permeable to the sound. He mentions the investigations of Thorn, who experimented in specimens removed by operation and on the cadaver. He was unable to pass even a fine probe into the tube in cases of approximately normal uteri. He regards doubtfully the claims of those who report having passed probes on the living. The case of Bischoff and Floeckinger are the only ones on record in which a sound was passed into the tube and demonstrated to be there by immediate operation. In both of these cases, however, there were myomata of the uterus. The predisposing cause of perforation is an unnatural softness of the uterine wall, produced by the various degenerations resulting from puerperal infection, carcinoma, myoma, pelvic abscess, pelvic tuberculosis, and the general diseases which are accompanied by general wasting. Hessert believes the accident may happen to anyone. The experienced man, however, will immediately recognize the injury and take prompt measures accordingly; the novice will remain in the dark as to the situation and will do further damage by attempting to carry out the proposed operation.

Any instrument used in intrauterine manipulation may perforate the uterine wall. The sound is much less dangerous than the curette. The sound makes a smooth hole while that made by the curette is apt to be ragged. A sound has never been known to injure the intestines. The

dilators are often the perforating instruments. This is especially true of the branched dilators, and results from a lack of information on the part of the operator of the exact direction of the cervical canal in the partic- ular case. If the perforation is made by the insertion of the dilators and dilatation is followed by the use of the placental forceps, there is no end to the injury which may result to the bowel. The result of the perforation depends upon whether or not there is infection carried into the peritoneal cavity, and upon the entrance into it of irritant solutions (sublimate, etc.), and upon the occurrence of visceral injury, mainly to the bowel, sometimes to the omentum. If the patient has been properly prepared for operation (disinfection of the operative field), and there is no infec- tion already existing in the uterus, in the cases of simple perforation of the uterus with no further injury, there follows little if any reaction. When infection does occur there results either a septic peritonitis, or there is set up a violent local inflammation with abscess formation, from which the patient may ultimately recover.

Many fatal cases have occurred as the result of the entrance of fluids used for irrigation of the uterus into the general peritoneal cavity. The injury to the bowel frequently consists of its separation from the mesentery. Perforation of the gut also may occur. A number of cases are on record where the bowel prolapsed through the perforation. The following principles should be observed in curettage or in any intrauterine manipula- tion. Make an accurate diagnosis as to the size, position, mobility, and consistency of the uterus; determine the presence or absence of tumors upon or within the organ; observe, if possible, its contractility; determine the condition of the adnexæ and the possibility of pus tubes, ovarian tumors, pelvic abscesses, and the like. In other words, get as clear a mental picture as possible of the pelvic organs.

In curetting post-abortum bear in mind the extreme friability of the uterus. The cervix should be amply dilated to admit the finger. The direction of the cervical canal and uterine cavity should be accurately determined by means of a graduated sound. The question of angulation backward or forward should be known before introducing branched dilators. Avoid the ratchet and screw. Dilate slowly so as not to split the cervix, meanwhile turning the instrument around to all points of the circumference. A number of operators advise the use of the fingers in the removal of placental remains. Dull and sharp curettes each have their advantages. Care should be exercised in using the placental forceps, determining surely that only intrauterine tissue is within their grasp before pulling down upon them. The use of irrigation, except in septic cases, is superfluous. Avoid strong solutions; never use sublimate.

Treatment of Perforation. When the accident occurs after antiseptic precautions, and is done with a sound, if there is no evidence of visceral

prolapse or injury, then the treatment is largely expectant. All irrigation should be omitted and the uterus packed. Perforation with a sharp curette is more liable to injure the intestines, but where the operator is immediately aware of the accident and the instrument is promptly withdrawn the treatment may be the same. Of course, there is always the chance of having infected the peritoneal cavity or of having injured the bowel. If the perforation is large, as shown by palpation or by prolapse of the omentum or the gut, then it is not safe to tampon. The rent in the uterus should be sutured either after opening the abdomen or after doing a colpotomy. When an infectious endometritis exists and the condition of the patient will allow it a vaginal hysterectomy should be done.

In all cases where there is evidence that the bowel has been pulled down or otherwise roughly handled by the curette, or the placental or the volsellum forceps, the best plan is to open the abdomen and examine carefully the whole intestinal tract. The bowel may be found torn across or it may be separated from its mesentery. This will require suture or resection. There may be active bleeding from torn mesenteric vessels. Both the large and the small intestine should be inspected, as there may be injuries at several points. The rent in the uterus should be sutured with interrupted catgut. This is usually easily accomplished, but there are cases in which the wall is so soft that the suture tears through. In such a case it is a good plan to open the vaginal fornix and pack gauze from the site of the injury down into the vagina. In rare instances a hysterectomy may be necessary.

Retrodisplacement of the Uterus. An effort is still being made to improve the operative treatment of this condition. It is very important not to subject every case to operation, and this is especially true of certain classes of cases.

Hirst[1] reports that five hundred and six of six hundred and fifty-three cases of retrodisplacement in his private and hospital practice have been subjected to operative treatment; four hundred and nine suspensions, seventy-six Alexander operations, and the rest divided mainly among the Gilliam, Ferguson, and the Richelot-Doleris operations. Several important questions must be decided in connection with retroposition:

1. Is the operative treatment satisfactory and is it destined to replace mechanical and all other treatment of retrodisplacement of the uterus?

2. Is the physician justified in urging this treatment?

3. What form of operation has the least risk, gives the patient the greatest security against recurrence, promises the least interference with subsequent childbearing, and affords the greatest symptomatic relief?

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[1] The Treatment of Retrodisplacement of the Uterus. A Clinical Study based on the Records of Six Hundred and Fifty-three cases. Therapeutic Gazette, May, 1905, vol. xxix. No. 5, p. 289.

The operative treatment of retroversion will never entirely displace other modes of treatment. Many cases are cured without operation; the majority of cases must be managed temporarily at least by a pessary; there is a small proportion of cases in which an operation is unjustifiable. It is likely, however, that the large majority of all such patients in the future will select the operative treatment. The records of specialists already show this to be the case. There is no better proof than that patients are becoming convinced from the statements of their friends and from their personal observations, that the most satisfactory result is afforded by this means. Otherwise there would not be a growing disposition to voluntarily select this mode of treatment in preference to the indefinite use of a pessary and to the never-ending medical attention which it often requires.

The operation for retrodisplacement is one purely of election. The condition is not dangerous to life; it is only detrimental to health and comfort. The case can almost always be managed in another way. It is not justifiable, therefore, to urge operative treatment as the only means of relief. The best course for the physician is to explain the position frankly, stating the relative advantages of the different plans of treatment, and allowing the patient to exercise her own will. There are many cases, however, in which the physician may advise the operative treatment as preferable to any other; in young unmarried women, in whom the long-continued use of a pessary is most objectionable; in working-women, who often find a pessary unendurable if they must do work in the erect posture; in cases of rectocele and cystocele requiring plastic surgery; in adherent retroflexions that have resisted attempts at replacement; and in the subjects of neuroses, including epilepsy, in whom the radical cure of the pelvic disorder may be followed by entire relief of the nervous symptoms. On the contrary, it may be the duty of the physician to discountenance an operation. The most discussed point in the entire question, and perhaps unfortunately so, is the one relating to the form of operation. To some operators *ventrosuspension* has proved satisfactory. One of these is Beyea,[1] who relates the history of the operation of ventrosuspension of the uterus and reports four hundred and sixty-five cases performed according to his technique. The principle of suturing the uterus to the anterior abdominal wall was first conceived and carried out by Tait in 1880. After removing the ovaries in a woman aged thirty-two, Tait secured the uterus to the abdominal wall by passing a suture through the fundus and the tissues of the abdominal incision.

Koeberle in 1885 described a laparotomy for intestinal obstruction in which he performed bilateral oöphorectomy at the same time, and

[1] The Technique of the Operation of Ventrosuspension of the Uterus. American Journal of Obstetrics, April, 1905, vol. li., No. 4, p. 462.

sutured the pedicle adnexal stump to one side of the abdominal incision in order to cure a retroversion. These observations, however, attracted no attention, nor was the principle considered until Olshausen brought the question before the Gynecological Section of the Naturalists Society of Berlin, and Kelly introduced the subject to the Philadelphia Obstetrical Society. The subject of Olshausen's paper was "Ventral Operations in Prolapsus and Retroversion of the Uterus." Kelly's paper was entitled "Hysterorrhaphy;" both were presented in September, 1886. Olshausen's operation consisted in fixing the horns of the uterus, at the origin of the round ligaments, to the abdominal incision with two or more silver wire sutures. Kelly sutured the tubo-ovarian pedicle, between the two pedicle ligatures, as they were then employed, close as possible to the uterus, to the anterior abdominal wall. All of these cases followed bilateral salpingo-oöphorectomy. They were fixation operations, and as the ovaries had been removed, resulted in no after complications and were satisfactory. Sanger in 1886 and 1887 had carried out several such operations. Some time after this Kelly advised the suture of the ovarian ligament alone to the anterior abdominal wall for the purpose of gaining a more normal anteflexed position of the uterus.

Olshausen and Kelly recommended the operation for the cure of complicated retroposition and for prolapsus. Later the operation was performed without removal of the tubes and ovaries. In these cases the technique consisted in suturing the round ligaments at or near the uterine attachment to the anterior abdominal wall by means of two silk sutures introduced into the tissues, a fixation being still always carried out. In 1890, Boldt, of New York, and Leopold, of Dresden, advised the use of sutures passed directly through the fundus uteri. Kelly was still using the ovarian ligament. The operation of Boldt and Leopold was designated as ventrofixation of the uterus, for an extensive amount of tissue was included in the sutures and the uterus secured firmly and permanently to the anterior abdominal wall. Kelly, at the forty-ninth annual meeting of the American Medical Association, May 7, 1895, reported his first one hundred and seventy operations of *suspensio uteri*, and severely condemned the operation named ventrofixation.

Since this time attention has been drawn to two distinct forms of operation which in many instances have been confused by applying to them indiscriminately various names, such as ventrosuspension, ventrofixation, hysterorrhaphy, and hysteropexy. There are two classes of operation: one a fixation in which the uterus is firmly fixed to the anterior abdominal wall and held there permanently; the other a suspension, whereby the uterus is so attached to the abdominal wall that a new ligament, formed of peritoneum and subperitoneal tissues, is produced by the traction of the uterus on its point of attachment. Ventrofixation is responsible for

the criticism which has been made in respect to this plan of surgical treatment in general. When the uterus is simply suspended a new ligament is formed which allows the uterus a certain range of mobility and interferes in no way with gestation or labor. The suspension operation of Kelly in the latter respect is very satisfactory. Its point of failure lies in the fact that the ligament formed from the union between the peritoneum and the uterus is not strong enough and as a consequence the operation is followed by a certain percentage of recurrences. In order to prevent these and to form a new ligament which allows free play to the fundus of the uterus, interferes in no way with pregnancy and labor, and yet is sufficiently strong to prevent recurrence, Beyea includes in his suspension sutures the inner fibres (one-quarter of an inch) of the rectus muscle. The sutures are not introduced from and in and out through the inner surface of the peritoneum, but are two sutures introduced from right to left through the inner fibres of the rectus muscle, parietal peritoneum, and uterine wall. The sutures, which are of silk, are tied with just sufficient tension to bring the uterus firmly in contact with the parietal peritoneum and yet not cut through the muscle tissue. Beyea has recently received communications from two hundred and seventy-two of his cases. Of these one hundred and fifty-three are married; forty-one of them have been pregnant; thirty-seven have gone to term and borne living children. Five have twice borne a child; two have given birth to twins; one twice. One woman died of eclampsia following a normal labor. In four instruments were employed at birth, once for posterior rotation of the occiput. In one there was an unusual amount of hemorrhage following childbirth, but it did not become serious. In two primiparæ labor was long and difficult. In one there was hemorrhage during pregnancy, the cause of which was not determined. In none of the forty-two labors, as described by the patient and the attending physician, were there complications which could be attributed to the operation. Nine of the one hundred and fifty-three women have aborted, all before the sixth month. Beyea knows of four instances only of recurrence. In three of these the recurrence took place before the patient had left the hospital. In two it resulted from the coughing incident to postoperative bronchopneumonia. In one it was produced by the resident physician in removing sutures from the cervix. In the only other case of recurrence, the woman, regardless of Beyea's advice, took up her duties as a housewife immediately on returning to her home, and lifted a child eighteen months old several times a day.

Holden[1] has determined the postoperative history of four hundred and forty-five cases of ventral suspension. He concludes from a study of them that successful symptomatic results may be expected in

[1] The Results of Ventral Suspension of the Uterus at the Johns Hopkins Hospital. American Journal of Obstetrics, 1905, vol. li., No. 3, p. 469.

about 60 per cent. of all those cases in which the retroposition is the sole or the most prominent abnormal condition. The prognosis is somewhat better in retroposition associated with a relaxed vaginal outlet, provided the outlet is also repaired, than it is in retroposition alone.

The great majority of nulliparæ who have symptoms caused by retro-position of the uterus suffer from *dysmenorrhœa* (90 per cent.). Multiparæ with retroposition suffer from dysmenorrhœa much less frequently (55 per cent.); 50 to 60 per cent. of those cases of dysmenorrhœa in which a retroposition of the uterus is the sole or the most prominent abnormal condition are relieved by suspension of the uterus. The prognosis is better in multiparæ with relaxed vaginal outlets (provided that in addition to suspending the uterus the outlet also be repaired) than in nulliparæ.

The suspensory ligament is usually in the form of a band or of one or two cords. The length averages 3 to 5 cm. After one year the length of the ligament does not depend upon the time elapsing since the operation or the thickness of the ligament.

The great majority of patients who have had the suspension operation suffer no adverse symptoms referable to the suspension during pregnancy or labor. The most frequent adverse symptom during pregnancy which can be referred to the operation is abdominal pain

Recurrence of the retroposition may occur after labor, but does not necessarily follow. If pregnancy does not intervene the percentage of recurrences is not more than 5 per cent. If an examination could have been made of all of the four hundred and forty-five patients of this series the percentage of recurrence would probably be less than 5.

According to Hirst the best operative treatment for retrodisplacement of the uterus is the *modified Alexander operation:* opening the inguinal canal, pulling out four to six inches of the round ligament, and fixing the thick, strong, proximal portion in the inguinal canal. The operation has no mortality; it leaves the pelvic organs in a normal anatomical position; it has the smallest proportion of recurrences and by far the least percentage of difficulties in subsequent pregnancies. It is interesting to note, says Hirst, that its opponents are those who have had the least experience with it; its advocates, those who have had the most. But it is not available unless the retroflexion is uncomplicated. Therefore, it cannot be used in more than a sixth of the cases. Moreover, the round ligament may be no thicker than a match-stick at the uterine cornu, and so attenuated in the inguinal canal that it cannot be found or cannot be utilized. This was the case in three of his seventy-nine operations; the attempt to shorten the round ligaments in the groin was abandoned, and the uterus was suspended through an abdominal incision. Suspension of the uterus has been hitherto the most generally available and useful operation. The

proportion of failures has been small: there were three recurrences in cases which Hirst had the opportunity to examine some time after operation, and only one case in which any difficulty occurred in subsequent gestations.

Hofmier,[1] using Olshausen's technique, reports one hundred cases of *ventral operation*. Of these fifty-seven were examined from one to fourteen years after the operation while personal communications were received from twelve. In five of the sixty-nine cases, from one cause or another, there was a recurrence. The author does not make a very clear distinction between fixation and suspension. He appears to be satisfied with the operation.

There is a natural feeling that this operation (ventrosuspension) is not ideal and that it will be supplanted by something better. The Gilliam or the Richelot-Doléris operation, Hirst believes, will most likely replace suspension. The latter is quickly and easily performed; it sustains the uterus satisfactorily in a good position; but whether it stands the test of time and occasions no difficulty in subsequent childbearing, the future must determine. A great improvement on the operation of Gilliam is the operation originally devised by Simpson, and which I reported several years ago in PROGRESSIVE MEDICINE. Montgomery[2] has recently perfected an operation which is, to a certain extent, the natural sequence of Simpson's idea. The only real objection to Gilliam's operation and to suspension of the uterus is the possibility of intestinal obstruction following a twist of the bowel about the suspending bands. As far as this is concerned the danger is overestimated, for Seegert finds but four cases in the literature of ileus following ventral suspension or fixation. They were the cases of Jacobs, Olshausen, Dardanelli, and Sonnenfeld.

As far as the permanency of the result goes, Beyea has shown very satisfactory results in ventrosuspension. Still an operation which suspends the uterus without producing a free suspensory ligament would seem more surgical.

Montgomery describes his operation as follows:

1. Through an abdominal incision a temporary ligature is passed beneath each round ligament about one and a half inches from the uterine cornu, and secured by a hemostat.

2. The two ends of one of these ligatures are threaded into the eye of a pedicle needle, the round ligaments seized with pressure forceps just external to the ligature, and drawn toward the medium line to render the external portion of the ligament tense. The peritoneum of the anterior

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[1] Die Ventrifixura Uteri bei Verlagerungen des Uterus. Zeit. f. Geburtsh. u. Gynäk., Bd. lv., S. 155.

[2] A New Plan of Procedure in Retrouterine Displacements. Surgery, Gynecology, and Obstetrics, July, 1905, vol. i., No. 1, p. 11.

portion of the broad ligament is picked up and snipped with scissors, affording a trap-door through which the pedicle needle carrying the ligature is introduced. The ligature is thus carried between the layers of the broad ligament until the abdominal wall is reached, when it is thrust through the muscular structure and is withdrawn from the needle external to the aponeurosis. A similar course follows with the second ligature.

3. Having drawn the superficial fascia away from the point made by the opening in the aponeurosis, the ligature is rendered tense, while pointed scissors are introduced closed alongside the ligature and their blades slightly separated as they are withdrawn. Their withdrawal is generally followed by a loop of the round ligament which is drawn up by the temporary ligature. Should the loop of ligament not readily pass through, it can be teased through by pushing back the tissues with the point of the scissors, while traction is made by the ligature. Loops of both round ligaments having been thus brought out upon the aponeurosis they are

4. Secured by catgut sutures to the aponeurotic layer. Careful examination is previously made to ensure the proper position of the uterus.

5. The wound is closed. A crescent-shaped incision through the skin fascia and aponeurosis above the pubes and a vertical incision, as suggested by Simpson, affords increased facility in reaching the ligaments and treating diseased conditions within the pelvis, but is prone to the formation of hæmatoma between the walls, which may become infected and mar the satisfactory convalescence.

The advantages Montgomery claims for this operation are: first, that it closely imitates the normal condition and employs natural ligaments for support, which are capable of undergoing hyperplasia during pregnancy and involution during the puerperium; second, it employs the strongest part of the broad ligament and leaves no lesions within the abdomen for the formation of unfortunate adhesions; third, it permits of the careful exploration of the contents of the pelvis and affords opportunity for the proper treatment of diseased conditions of the uterine appendages and the vermiform appendix.

It will be seen that in such an operation as that of Montgomery the strongest part of the round ligament is used to support the uterus. Reduplicating the proximal portions of the round ligament and depending on the weak distal ends for support is not reliable says Hirst; it is not founded on a good principle and probably will not have a permanent place among the operations for retroflexion. This was one of the principles insisted upon by Goldspohn, who at the present time uses his own operation, bi-inguinal cœliotomy, in selected cases only. He employs it especially as a substitute for the Alexander operation; in this way he is able to explore the pelvis digitally, and discover light adhesions of the ovary and tubal

ostia, which might otherwise escape detection. He also claims that without bi-inguinal cœliotomy there is sometimes difficulty in drawing out the round ligaments and in pulling the uterus up into position. The latter occurs if there is a high grade of retroflexion. Goldspohn[1] has examined one hundred and fifty-five of two hundred cases in which he has used his operation. The examinations were made at an average interval of twenty months. There was a recurrence in but one of these cases. There were no postoperative hernias, although fifteen concomitant hernias were cured by the operation. Twenty-one patients have given birth to one or more children each, and the only abnormal labor was a breech presentation. In none of these was there a return of the displacement after labor. Death occurred in two cases out of his series: one from cerebral embolism, one from the slipping of a ligature; a mortality of 1 per cent.

Fehling[2] has had one hundred and six *Alexander-Adams operations*. All healed perfectly, but 4.4 per cent. had a recurrence.

Shortening the uterosacral ligaments frequently neither restores a uterus to a normal position nor keeps it there. Judging by trials both on the living and dead body, Hirst thinks it is the most useless of all operations for this condition. Vaginal fixation has given the largest proportion of failures and, if it has succeeded, the highest percentage of difficulties in subsequent gestations.

The only really new suggestion of the year comes from Coffee, who says: The so-called true ligaments of the uterus are chiefly muscular prolongations of that organ. The only known function of a muscle fibre is to contract and to produce motion. A muscular fibre will under no circumstances stand a constant strain, as is necessary for the support of an organ. The uterus is a movable organ and, therefore, needs an agent to produce this motion. This function is supplied by the muscular ligaments, which assume the important functions of motor or accessory ligaments and which have the power to restore its equilibrium and possibly to move it. The uterus has by far the greatest peritoneal support of all the other organs of the abdominal cavity; this is shown by the very broad attachment of the broad ligament. The peritoneum is apparently the universal ligament of all the organs in the abdominal cavity.

Coffee's[3] operation consists of pleating the round ligaments to the anterior face of the uterus and then uniting the contiguous peritoneum

[1] Fourth Detailed Report of the Superior and Lasting Results of My Operation for Simple and Complicated Aseptic Retroversion of the Uterus. Journal of the American Medical Association, November 18, 1905, vol. xlv., No. 21, p. 1546.

[2] Zur Technik der Alexander-Adams' chen operation. Zent. f. Gynäk., 1905, Nr. 6, S. 161.

[3] Surgical Treatment of Displacements of the Uterus. Denver Medical Times, January, 1905, vol. xxiv., No. 7, p. 340.

to the uterus over the line of suture. He gives the following description: Seize the round ligament with its surrounding peritoneum about one and a half inches from its origin, and stitch it by four or five interrupted sutures of catgut (formalin or chromic acid) to the side and front of the uterus about the insertion of the broad ligament. Seize the round ligament about an inch and a half from the lower suture placed in the first row and bring this knuckle back to the origin of the round ligament and fasten with interrupted sutures as before. Each time the round ligament is brought to the side of the uterus a double layer of peritoneum is also brought down, which in reality forms a plication of the broad ligament. The interrupted sutures are now covered by bringing the peritoneum of the broad ligament over them and uniting it to the anterior surface of the uterus by a continuous fine catgut suture.

Fibroid Tumor of the Uterus. The choice between myomectomy and hysteromyomectomy in fibroid tumors of the uterus has been put upon a scientific basis by the work of Winter, which I reviewed in last year's PROGRESSIVE MEDICINE. During the past few years several papers have appeared which bear largely upon the pathology of fibroid tumors and discuss the indications for operation. The cardiac complications have received a great deal of attention.

PATHOLOGY, DEGENERATIONS AND COMPLICATIONS OF FIBROID TUMOR. Webster[1] reports a series of two hundred and ten cases of fibroid tumor. In this number he found the following degenerations:

Calcareous	2
Œdematous	6
Cystic	13
Myomatous	4
Suppurating	10
Adenocarcinoma of cervix	1
Sarcoma	2
Hemorrhage	3
Necrobiosis	11—52

The following pelvic complications were noted:

Broad ligament development	11
Prolapsus uteri	7
Retroposition of uterus	11
Hæmatosalpinx	6
Ovarian cystomas	12
Unilateral salpingo-oophoritis	7
Bilateral salpingo-oophoritis	42
Unilateral ovaritis	3
Bilateral ovaritis	29
Hernia	4
Appendicitis	26
Pregnancy	6—164

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[1] A Consideration of Fibroid Tumors of the Uterus, based upon a Study of a Series of Two Hundred and Ten Cases Treated Surgically. American Medicine, March 11, 1905, p. 401.

In ninety-nine of the cases there were pathological changes in the tubes and in the ovaries. It is not easy, says the author, to explain the inflammatory changes. In many cases there is no history of infection, and it may be that the etiological factors are often venous enlargement and engorgement or other circulatory disturbance, mechanical irritation, or pressure of the tumor. In other instances, there is definite evidence of an infectious attack prior to the recognition of the tumor or afterwards. In but three of Webster's cases was there any association with malignancy. In the latter respect this does not approach the series collected by Noble, who found malignant complications in 5.2 per cent. Klein[1] reports a series of two hundred and six cases in which 4.85 per cent. were associated with malignant degeneration of the tumor or a coincident malignant tumor of the uterus. Lewis[2] from the statistics of 1518 cases found in the literature computed 4.75 per cent. of malignancy.

Parasitic Fibroids. Reuben Peterson[3] reports three cases of subperitoneal pedunculated fibroids which had become parasitic, drawing their blood supply from the omentum, and reports twenty other cases collected from the literature. He notes the fact also that torsion of the uterus may occur in connection with rotation of a fibroid and result in the complete separation of the fundus uteri and tumor from the cervix. Such an occurrence has been reported recently by Ricard.

Fibroid Tumor of the Broad Ligament. Burkard[4] reports several cases of primary fibromyomata of the broad ligament. Sänger was the first to accurately classify these growths as primary desmoids of the pelvic connective tissue. They originate from the smooth muscle cells of the broad ligament and are especially apt to arise near the uterine cornu, where the broad ligament is rich in muscle cells.

SYMPTOMS. *Pressure Effects.* Webster found pressure effects in a considerable percentage of cases, chiefly in those in which the tumors were situated mainly within the pelvis. Such cases are impacted fibroids, intraligamentous ones, or those bound down by adhesions. Pressure occasionally produces oedema or varicosity in the lower extremities; pressure on the nerves is rare. Interference with the ureter sufficient to cause hydronephrosis is rare. Pressure upon the rectum sufficient to cause more or less interference with defecation is not very common. Intestinal obstruction is very infrequent and is either due to adhesions or to an extraperitoneal fibroid, the gut being stretched over the surface of the growth.

[1] Blutuntersuchungen bei Unterleibsleiden der Frauen, besonders bei Uterus Myomen. Zeit. f. Gynäk., 1905, Nr. 31, S. 960.

[2] Malignancy in Uterine Myomata. Illinois Medical Journal, Springfield, October 1905, vol. viii., No. 4, p. 313.

[3] Migratory Uterine Fibroids. American Journal of Obstetrics, July, 1905, p. 56.

[4] Beiträge zu den primären Fibromyomen der breiten Mutterbänder, Wiener klin. Wochenschr., Bd. xvii., Nr. 17, S. 423.

Hemorrhage. According to Winter[1] hemorrhage occurs in about two-thirds of the cases of myoma; most frequently in submucous tumors. Menorrhagia is the usual type of hemorrhage; metrorrhagia is the least frequent. Metrorrhagia as well as hemorrhage about the time of the menopause should always awaken the suspicion of malignant degeneration; the same symptoms may also be caused by one of the ordinary forms of degeneration or by a submucous tumor.

Pain. In regard to the symptom of pain in fibroids, Winter finds from an analysis of his cases that the size of the tumor alone is seldom the single factor in the production of pain; as an average there is less pain in the larger tumors than in the small and the middle-sized ones. In respect to the location of the growth, subserous tumors most frequently produce pain. Those myomata also which are prevented from free growth into the peritoneal cavity by a subperitoneal or an intraligamentous development may be painful. Dysmenorrhœa is frequently produced by the myoma alone, especially when it has a submucous position. The cause of pelvic distress often lies in a complicating or adnexal disease. In the secondary alterations, such as malignant degeneration or implantation, necrosis, softening, and suppuration, pain is a strikingly frequent symptom.

Renal Complications. Webster says that renal disturbances are more common than is generally known. In 30 per cent. of his cases there was noted one or more of the following indications of renal involvement: deficient amount of urine or urea, albumin, casts, and œdema of the feet. The factors concerned in the production of these renal disturbances, are probably identical with those causing the cardiac changes in myoma.

Cardiovascular Changes. The cardiac and circulatory symptoms of myomata have, in the past two years, received a great deal of attention. According to Fleck, whose paper I reviewed last year, these changes are not due to hemorrhage but to a pathological secretion of the ovary which also is a cause of the fibroid tumor itself. Others have ascribed a specific action to myomata themselves in the production of myocardial degeneration.

In Webster's cases 25 per cent. showed cardiovascular changes. He quotes the statistics of Strassmann and Lehmann, Fleck, Roger Williams, and Wilson. The percentage of cardiovascular involvement reported by these men ranges from 40.8 (Strassmann and Lehmann) to 46 (Wilson).

More extensive observation is necessary to speak positively in regard to the influence of uterine fibroids on the cardiovascular apparatus, but that there is an important relationship must be admitted by all who have

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[1] Die Wissenschaftliche Begründung der Indikationen zur Myomoperation. Zeit. f. Geburtsh. u. Gynak., Bd. lv., S. 49.

given any consideration to the subject. Baldy,[1] who draws particular attention to the cardiac complications in myoma, reports 3.55 per cent. of sudden deaths following operation for fibroid tumor in three hundred and sixty-six cases at the Gynecean Hospital. These fatalities resulted from pulmonary embolism, from the fourth hour to the thirty-fifth day after operation. He compares this with the percentage of sudden deaths in the 3047 other cases admitted to the hospital during the same period of time, which was but 0.2 per cent. He thinks the difference is startling and at once suggestive. The different theories advanced by different writers as to the cause of these accidents he thinks may or may not be true, but the fact remains: that there is some factor in the case different from other cœliotomy operations. Keep a patient in bed as long before an operation as possible, administer any and every treatment conceivable, pick the cases early or late, and the accident will occur in spite of all precautions, without the slightest warning, so that we are helpless to anticipate or prevent it. Baldy quotes Richardson who says that the serious hemorrhage in fibroids may have something to do with these accidents. Baldy himself believes that bleeding is the most serious symptom which accompanies fibroids.

Klein emphasizes the importance of *blood examinations* in determining the question of operation in a given case of fibroids and also the prognosis. From his observations he believes that menorrhagia and metrorrhagia are not alone the cause of blood dyscrasias in fibroids. The dyscrasia occurs in those cases where hemorrhage is not a prominent symptom and for this reason he believes that fibroids exert an evil metabolic influence upon the blood and the heart.

Alterations of the heart in fibroid tumor cases, says Winter, are observed in two forms: as valvular lesions, and as degeneration of the heart muscle. There are but two cases of valvular lesion recorded in the literature which were confined by autopsy: one of Dower's and the other of Gessner's. Gessner's case was the only one in a series of six which showed valvular disease and neither Strassmann in six nor Fleck in eleven found any pronounced disease of the valves. Alterations in the heart muscle have been found much more frequently. Thus Hofmeier, Gessner, Strassmann, Mahler, v. Meyer, Runge, Saenger, Kessler, and Fleck have together reported twenty-six autopsy cases, comprising brown atrophy, fatty degeneration, and myofibrosis. Winter, analyzing these cases, excludes all those in which some other factor may have been active in the production of the heart lesion (necrosis of the tumor, prolonged operation, and the use of chloroform), and finds but five cases in which there is no other explanation for the cardiac disease but the myoma

[1] The Mortality in Operations upon Fibroid Tumors of the Uterus. American Journal of Obstetrics, September, 1905, p. 371.

itself. To these he adds five cases of his own. Altogether the lesions are:

Brown atrophy	4
Fatty degeneration	4
Myofibrosis	1
Simple atrophy	1
	—
	10

In discussing the evidences of heart disease in myoma, Winter criticizes the reports of Strassmann and Fleck, both of whom found 40 per cent. of cardiac lesions by clinical examination. Winter did not trust to himself in a series of two hundred and sixty-six patients, especially examined for cardiovascular lesions. He had the heart examined in all of these cases by specialists in internal medicine. Their results in the series are given as follows:

1. The condition was entirely normal; clear tone, normal outlines 163 times—60 per cent.

2. Murmurs (78) and impure tones (3) were observed 81 times—30 per cent.

The significance of these murmurs were thus indicated by the specialist:

Anæmia	52
Apparent anæmia	16
Arteriosclerosis	6
Neurasthenia	2
Adipositas cordis	2

3. Dilatation and hypertrophy (valvular disease and myocardial alterations excluded) 16 times—6 per cent.

4. Heart failure 3 times—1 per cent. Primary mitral insufficiency once and mitral stenosis twice.

5. Alterations in the myocardium were observed 3 times—1 per cent.

The difference in his own statistics (1 per cent.) and those of Freund (8 per cent.) in the percentage of valvular insufficiency, is explained, he thinks, by the great care he exercised in properly classifying his cases. The fact is that in his series there were at first thirteen cases of valvular insufficiency. By a careful examination and control of the cases after operation, however, only three were found to be absolute cases of valvular disease; the others were evidently the result solely of anæmia. In relation to endocarditis, the author believes from a study of his own material that neither the anatomical nor the clinical examination speaks for a close connection between endocarditis and myoma.

Alterations in the myocardium were noted in three of Winter's two hundred and sixty-six cases. All of these cases were examined several years after operation and the cardiac condition remained the same, thus sustaining the diagnosis. This percentage is so strikingly at variance with that given by Strassmann (40.8 per cent. in seventy-one cases) that

there is either a difference in their conception of what constitutes myocardial degeneration or else a difference in their interpretation of physical signs. As Winter's examinations were all conducted by an internalist he believes his figures are correct.

In reference to the form of degeneration and the cause of it in the particular case, Winter concluded, from a study of the reliable data, that brown atrophy of the heart may be produced by large myomata which cause serious general effects. Fatty degeneration may be produced by continuous severe bleeding. The fact that fatty degeneration of the heart does not occur from the hemorrhage in carcinoma is easily understood; in cancer we are dealing mostly with a disease which runs a short course.

In Winter's series of two hundred and sixty-six cases, he found fourteen (5 per cent.) of cardiac dilation. Among these he found that some could be accounted for by nephritis, arteriosclerosis, emphysema, etc., and by far the greater number occurred in cases where there had been serious hemorrhage and anæmia. It is well known that anæmia can produce dilatation. As a result of his observations Winter concludes that *there is no evidence of any specific connection between heart disease and myoma.*

In order to estimate the effect of operation and thereby to draw conclusions relative to the cause of the cardiovascular changes in myoma, Winter has closely observed a number of his fibroid cases, in which there was a cardiac complication, for a period of six months to nine years following operation. The examination of the heart in each case was made by the same internalist who had made the original examination, and without any knowledge of, or reference to, his previous diagnosis. These cases included three of valvular lesion, four of primary myocarditis, and nine of anæmic dilatation of the heart. As a result he finds:

1. That valvular disease (endocarditis), in itself, is uninfluenced by the removal of a fibroid.

2. That dilatation of the heart in connection with valvular disease, which may well be due to the anæmia present in a given case, may disappear after the general condition is improved and the anæmia is cured.

3. That disturbances of compensation, in valvular disease, which are due to a dilatation or a degeneration of the heart muscle, in connection with the anæmia, may be relieved. Therefore, in anæmic myoma patients, having valvular heart disease, operation will be beneficial by preventing secondary (anæmic) dilatation and degeneration.

4. That primary myocarditis in myoma patients who are not anæmic will not be influenced by the removal of the myoma. With coincident anæmia one can presumably prevent fatty degeneration by operating. The same is true of brown atrophy.

5. Dilatation of the heart due to anæmia is surely relieved by curing the anæmia.

6. The cause of heart lesions in myoma lies in the anæmia. Therefore, the myoma must be removed with the object of curing the anæmia.

(*a*) In valvular disease and primary myocarditis, as quickly as the hemorrhage is greater than customary. No internal or palliative measures will do in such cases.

(*b*) In the absence of diseased valves and primary myocarditis, as soon as the symptoms of dilatation develop.

With regard to the result of the immediate operative procedure itself, Winter reports seven operations in the presence of valvular heart disease. In two of the cases there was marked disturbance of compensation. The course of five cases, in which supravaginal amputation was done, was entirely afebrile. In five cases also there were no cardiac disturbances, although the pulse frequently was slightly increased, ranging about 100, a few times as high as 120. In three cases, because of rapid pulse and weakness of the heart's action (without any further disturbance of the circulation) preparatory treatment with digitalis was required. In one of these cases the pulse was better after the operation than before. In two cases an embolus was carried to the lung: once a dry pleurisy resulted; once an embolic pneumonia; both cases recovered. The author always paid great attention to the heart in these cases. If there was the slightest defect in compensation, preparatory treatment by means of rest, good nourishment, and digitalis was prescribed. The operation should be performed as quickly as possible, preferably by way of the vagina. Ether is the best anæsthetic.

The author also reports six operations for myoma associated with well-marked myocardial alterations. In all of these but one, there was an increased frequency of the pulse, 20 to 30 beats, after operation, and this persisted much longer than when the heart is healthy. Serious disturbance of compensation, however, did not appear. Of fifteen operations for myoma, associated with anæmic dilatation of the heart; in five there was not the slightest abnormality of the cardiac activity; in four the frequency of the pulse was greater and remained so for a longer time than usual after operation; in one case there was a thrombosis of the saphenous vein; in one there was a light infection; in one an embolic pneumonia; and in two of the cases fatal peritonitis occurred.

From this experience the author would say that with great care and precaution, myoma operations can be safely carried out, so long as no permanent disturbances of compensation (marked œdema, ascites, cyanosis, and dyspnœa) are recognizable.

Boldt[1] reports thirty-seven instances of circulatory disturbance in seventy-nine cases of fibroid tumor of the uterus. He divides them into several classes:

Class I. Five patients had dyspnœa on exertion, also a small rapid pulse with arhythmia. There was moderate hypertrophy of the right ventricle. The urine showed albumin and casts on one occasion.

Class II. One patient with orthopnœa and irregular and intermittent pulse, increase of dulness over the entire cardiac area; hepatic dulness slightly increased; albumin and casts in the urine.

Class III. One patient had an arhythmic, hard pulse, with occasional attacks of angina pectoris. In the urine there was a trace of albumin and there were some granular and hyaline casts.

Class IV. Nine patients had a rapid pulse, from 100 to 128 beats per minute, which on sudden exertion increased from 10 to 20 beats; the pulse was small and easily compressible. All the patients were easily fatigued on exertion. The urine was normal.

Class V. Twenty-one patients complained of no symptoms referable to the heart, but the pulse was small, of low tension, occasionally irregular, from 86 to 110 beats per minute. Pain on pressure over the second sterno-intercostal space was noted five times, associated with pain on pressure over the apex four times. Pain on pressure over the apex with the point of the finger alone was observed nine times. There was a trace of albumin in the urine in three instances associated with occasional granular and hyaline casts in two. There was no appreciable change in the heart area in any of these cases.

In this series, Boldt operated upon thirty-four of the thirty-seven cases. Four deaths occurred from heart failure; one had angina pectoris and died suddenly at the completion of the operation. One, who had a chronic nephritis died on the sixth day with symptoms of cardiac failure which had appeared on the fifth day. The other three died on the first, second, and fifth postoperative days. The blood in all of hese patients had been more or less altered from the normal standard. In one instance the hæmaglobin was reduced to 25 per cent. In four of the cases there was thrombosis of the veins of the lower extremity. All occured in women whose hæmaglobin was below 40 per cent. Boldt agrees with Winter that the only proper and scientific method of getting at the exact relation between myoma uteri and the heart and the other internal organs is to have competent diagnosticians in internal medicine make a careful examination of each patient and to have the same examination made from time to time subsequent to the operation.

The direct influence of myoma upon the heart has been exagger-

ated. There is scarcely any reasonable doubt that anæmia is the under-lying immediate cause of the cardiac changes. It will be seen from the admirable work of Winter that *primary* endocardial or myocardial disease is extremely infrequent in fibroid tumor. These diseases almost never occur as the result of fibroid tumors unless anæmia is present. Moreover, Winter finds by his careful study that the circulatory disturbance produced by a fibroid is relieved by the removal of the fibroid. Winter has quite conclusively shown that anæmic disorders of the heart have been spoken of improperly as myocardial disease, and that the clinical diag-nosis of myocarditis or of endocarditis in view of this fact should be undertaken only by a specialist in internal medicine.

Baldy's paper has very strikingly estimated the danger of pulmonary embolism. It is significant that this author, although he does not enter into a discussion of the reason for the cardiac changes in myoma, places the hemorrhage as *the most important* symptom, and operates as soon as this occurs.

MYOMAPHOBIA AND NERVOUS SYMPTOMS OF FIBROID TUMOR. Although the old idea that disease of the genitalia is the most import-ant cause of a general neurosis (hysteria, neurasthenia) is no longer entertained, it would not be generally affirmed that there is absolutely no connection between the two. Either the genital disorder is super-imposed upon a condition brought about by heredity, exhausting diseases, or continuous nervous irritation, or much more rarely, the genital disease of itself by its unfavorable influence, prepares the body and the mind for a nervous affection. Winter has endeavored by an analysis of one hundred and fifty-eight of his cases to see what relation the uterus bears to nervous diseases. An examination of this series showed that there were:

	Per cent.
Fully normal in every way	99 or 63
Alterations to the central and peripheral nervous system of different forms and grades	59 or 37

The author has separated the latter into several groups:

1. Those of mild degree which have no connection with the myoma and are with certainty attributable to other causes . . 19
2. Those of mild degree which are certainly connected with the myoma 33
3. The severe, general neuroses (without involvement of the psyche, for which no particular etiology is recognizable . . . 5
4. The psychoses 2

The first group (19) comprises mild hysteria or neurasthenia, which is attributed by the patient to other causes, *e. g.*, husband's death, puer-peral fever, household cares, etc.

The second group (33) comprises those neuroses for which no plausible reason can be given by the patient, nor found by the physician. The

symptoms here may be described as generally neurasthenic. The patient will say she is "very nervous," "easily excited," "very timid," "inclined to weep;" they complain of insomnia, loss of memory, tremors, feeling of anxiety, etc. The objective examination of the nervous system in these cases is negative except for slight alterations in the tendon reflexes. The cases of this group seem to have some sort of connection with the myoma. Common to almost all of these cases a severe anæmia was found. In twenty-seven instances there was severe hemorrhage; in ten women the hæmaglobin fell below 50 per cent. In this group Winter finds that the disturbance of function of the central nervous system, brought about by defective metabolism incident to the anæmia, is responsible for the symptoms; the myomata in themselves, however, produce no nervous affections. In the group comprising the several forms of hysteria and the neuroses, no direct connection between the myoma and the nervous disease was discovered. Nervous conditions therefore would only indicate an operation for myoma, in so far as they depend upon the anæmia produced by excessive hemorrhage.

The group of psychoses was analyzed and the following deductions were made:

1. Slight alterations of the nervous equilibrium (as in group 2) may be caused by myomata through serious somatic disturbances, *e. g.*, hemorrhage.

2. Psychoses may be absolutely independent of the myomata.

3. Psychoses may be cured occasionally by myoma operations, when they exist as a consequence of a severe disturbance of the general health.

4. Psychoses alone can scarcely be an indication for operation; for whenever they exist as the result of a myoma, there are also somatic changes which a priori indicate operative interference. At the present time Winter would hold that a psychosis is not a justifiable indication for operation, when the myoma plays a role in the erroneous mental conception. The myoma in such a case is not the cause of the psychosis, but merely a temporary fixed point of the erroneous idea. An hysterical or a physically diseased woman should never be informed of the existence of a myoma unless it is necessary to remove it.

As a result of these observations Winter would conclude: 1. That functional disturbances in the central nervous system, so far as they are produced by the weakening influence of the myoma, may be relieved by operative treatment and occasionally may constitute the indication for operative interference.

2. That psychoses and general neuroses (hysteria) are not customarily explained by the presence of myoma and cannot be cured by its removal.

TREATMENT OF FIBROMYOMA. At the present time, scarcely any active treatment of fibroid tumor, save the operative, is in vogue. Never-

theless cases continually occur where for some reason or other operation is either refused or the condition of the patient makes it unadvisable. For this reason the paper of Englemann,[1] of Bad Kreuznach, may be reviewed with profit. This physician has had an experience which comprises about 1400 cases of myoma. He believes that by far the largest proportion of myoma as they occur in women never give rise to symptoms. He calls attention to the fact that the degenerations and complications of myoma, as reported by various observers, occur in the worst sort of cases, viz., those that fall into the hands of the operating gynecologist. He recommends and has used with great success, systematic tamponade of the vagina and rest in bed at the menstrual periods, in order to diminish the amount of hemorrhage. The tampon is renewed daily or oftener, and each time the vagina is douched thoroughly with sterile water as hot as the patient can bear. The diet should be nutritious but easily digested. The author also employs galvanism, injections of ergot, massage, and salt baths. He does not claim that these agents cause a myoma to disappear. He believes, however, that carried out in connection with general measures, they may prevent a tumor from increasing in size or even, in some cases, produce a slight atrophy. Ergot is given in the form of a subcutaneous injection. According to Winter the use of ergot is only productive of results in purely interstitial tumors, less than the size of a child's head.

Curettage of the uterus should only be undertaken when submucous growths can be positively excluded, otherwise injury of the capsule may result in a necrosis of the tumor. It is most efficacious in cases of subserous and small interstitial growths. Because the result of curettage is always doubtful it should never be depended upon in the presence of serious anæmia.

Deaver[2] reports two hundred and fifty operations for fibroid tumor of the uterus. He thinks the safe attitude toward fibroid tumor lies between the two extremes—those of ultraconservatism and ultraradicalism. While he recognizes the fact that malignant degeneration or association does occasionally occur in a myomatous growth of the uterus, and that pyosalpinx, ovarian cyst, and peritoneal adhesions are found in no insignificant proportion of patients, yet, he says, there are many women in whom fibroids of even considerable size are provocative of no especial discomfort, and in whom death finally occurs from some intercurrent and entirely independent disease.

In his judgment fibroids of the uterus do not require removal unless

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[1] Beobachtungen und Erfahrungen über Myome der Gebärmutter. Archiv. f. Gynäk., Bd. lxxvi., Heft 1, S. 133.

[2] Hysterectomy for Fibroids of the Uterus with a Report of Two Hundred and Fifty Operations. American Medicine, April 15, 1905, vol. ix., No. 15, p. 601.

they are productive of symptoms, but when they do become symptom-producing they should be removed promptly before the patient has been weakened by toxæmia, hemorrhage, or sepsis. Deaver usually performs supravaginal hysteromyomectomy. This he believes to be easier of execution in the majority of cases; it has a lower rate of mortality, and there is less risk of injuring the ureters. The possibility of malignant changes in the cervix following operation he does not consider. Panhysterectomy is to be employed only when intraligamentary growths, whether uterine or ovarian, render the performance of supravaginal amputation difficult or dangerous. Myomectomy is applicable only to younger women, in whom the tumors are few in number and subperitoneal in character. From his experience, Deaver believes it very important that the ovaries, or a part of one ovary, should be preserved in every woman who has not reached the age of the menopause, unless they are distinctly and indisputably diseased, or unless their retention would needlessly prolong and complicate the operation. In Deaver's last one hundred and five supravaginal hysterectomies the mortality has been but 2.85 per cent. In his last forty-eight operations, there have been no deaths. In the series he reports of two hundred and fifty cases he has had the following mortality percentage.

	Cases.	Per cent.
Supravaginal hysterectomy	219	9.13
Abdominal myomectomy	11	0.00
Panhysterectomy	14	7.14
Vaginal hysterectomy	3	0.00
Vaginal myomectomy	2	0.00
Vaginal myomectomy (Downes)	1	0:00

Baldy does not make much of the degenerations of a fibroid tumor. He thinks that with two exceptions, necrosis and malignant degeneration, they neither imply symptoms nor danger. He thinks any estimate of the number of deaths from degeneration is pure guesswork. Nevertheless, Baldy arrives at the same conclusion as Noble, who was the pioneer in the active investigation of the degenerations of fibroid tumors, that fibroid tumors should be operated upon when first seen and early. Webster believes that as a rule all large or growing tumors or small ones, which cause troublesome or serious symptoms, should be treated surgically. He reports:

Vaginal hysterectomies	36
Abdominal panhysterectomies	46
Supravaginal hysterectomies	48
Abdominal myomectomies	45
	— 175

with five deaths, a mortality percentage of 2.8 per cent. (In estimating this percentage he has not included three vaginal myomectomies, two

salpingo-oöphorectomies, three vaginal ligations of the uterine arteries, and twenty-seven removal of submucous polypoidal growths.)

Winter discusses very fully in his paper the indications for operation. I have already reported what he says in this connection with reference to heart disease and the neuroses. In regard to hemorrhage alone, without cardiac involvement, he says that in menopausal cases conservatism is unjustifiable, unless malignant and other forms of degeneration can be excluded. In pure menorrhagia, the degree of anæmia will figure largely in the indications for operation. Serious anæmia in the presence of small tumors signify a submucous development and these call for operation. Anæmia with hæmaglobin above 30 per cent. entails no especial danger from an operation when the necessary precautions are observed.

With respect to vesical symptoms in myoma, Winter concludes that the mere presence of these are not alone sufficient to indicate extirpation of the growth. In every case they should be carefully investigated. When the myoma appears to be directly or indirectly responsible for them and when they are of serious clinical significance, they may be correctly taken as the basis for a removal of the growth. Finally, asks Winter, shall a myoma be exposed to operation when it is not giving rise to symptoms? This question in a general way can at once be answered in the negative except for three sorts of tumors, viz.:

1. The pedunculated subserous myoma.
2. The excessively large myoma.
3. The rapidly growing myoma.

A pedunculated subserous tumor with a narrow pedicle subject to special complications, which result from an interference with its blood supply.

In thirty-one subserous myomata with maximum attachment to the uterus of 4 cm. the author found:

	Times.	Per cent.
Sarcomatous degeneration	2	6
Torsion of the pedicle	4	12
Parasitic attachment	2	6
Softening	4	12
Calcareous infiltration	2	6
Necrosis	2	6

In but half of these cases was there neither clinically nor histologically any complication. This half were, as a rule, about the size of a child's head, while 50 per cent. of the complicated cases were of a larger size. From this the author would say that even though they produce no symptoms, pedunculated, subserous tumors with a pedicle 4 cm. and under in diameter should be exposed to operation; at least after they have exceeded the size of a child's head. This advice takes cognizance of the fact that operation in such cases is practically devoid of danger, when the operation is performed before complications arise.

Tumors as large as a man's head and over are called giant tumors. It is not unlikely that these tumors from their size alone and from the amount of blood which they require for their nourishment, seriously impair the general health.

Times.

In 26 such cases Winter found more or less œdema of the lower
extremities 5
Dyspnœa, for which no other cause could be found . . . 5
Emaciation, anorexia (without hemorrhage or other explanatory
symptom) 4
Albuminuria 2
Affections of the heart 9

He is not in a position, he says, from clinical examination alone to establish definitely the dependence of these complications upon the tumor alone. Of seventeen such giant tumors examined histologically:

There was no degeneration in 3
Total necrosis had occurred in 1
Sarcomatous degeneration in 2
Total suppuration in 1
Softening of different degrees in 10

From these facts the author does not feel that he is justified in formulating the principle that every large myoma requires operation. However, he says, just as soon as disturbances in the general condition arise (dyspnœa, emaciation, œdema, albuminuria) operation should be performed at once, irrespective of the usual myoma symptoms. The remaining class of cases is that of the rapidly growing myoma. The grounds for supposing that every such tumor requires operation, is based upon the assumption either that it would in a measurable time become so large as to cause serious symptoms, or that the rapid enlargement represents forms of degeneration which have a serious significance. There is some difficulty in saying in many cases whether a tumor grows abnormally fast or not; there is no scale of regular growth, and each tumor varies considerably according to its blood supply and its tendency to preponderate in fibrous or in muscular elements. In twenty-two cases of this sort the author found:

Times.

Normal structure of fibroma 8
Pregnancy (intrauterine) 2
Total suppuration 1
Circumscribed embolic necrosis 1
Early sarcoma 1
Softening (hyaline) in different stages 9

In only three of the latter was there so much degeneration found that it could actually be considered of any import. Therefore, as the operation can be adopted later if necessary, the author thinks that it is not justifiable to remove a myoma because of its rapid growth alone; careful attention to the case in such instances is imperative. In five rapidly

growing cases at the time of the menopause, however, Winter found advanced degeneration. He would make a distinct difference, therefore, in the indication for operation according to the time at which rapid increase in size occurs. The indication for operative interference, because of rapid growth, applies principally to patients at the menopausal period of life.

There are so many exceptions to Winter's general rule, *i. e.*, to not operate upon a myoma unless it is producing certain symptoms, that the question arises would it not be safer to follow the ideas of Noble, and operate on every case as soon as it comes under observation? We can arrive at some opinion by comparing the dangers of the operation with the dangers inherent to the tumor itself. The mortality of myoma operations in general should not be above 5 per cent. at the present time in the hands of experienced men. Thus Deaver's percentage of deaths for two hundred and fifty cases reaches 8.4 per cent.; but for his last one hundred and five cases and in Webster's one hundred and seventy-five cases it is only 2.85 per cent. I agree thoroughly with Baldy that "no living man" can estimate how many women will die from fibroid tumors if they are not removed. The statistics of Noble certainly point to death in 5.2 per cent. of the cases. Thus in Noble's series he found:

	Per cent.
Carcinoma of corpus uteri	2.4
Epithelioma of cervix uteri	1.0
Sarcoma	1.8

Wide spread necrosis of the tumor with liquefaction and cyst formation from any cause whatsoever would also predispose to a fatal termination. However, hyaline degeneration, calcareous infiltration, and most of the other varieties of change will not of necessity prove to be a serious com, plication. Furthermore, such complications as chronic oöphoritis, appendicitis, prolapse of the uterus, dermoid cyst of the ovary, retroversion, etc., (mentioned by Noble, Webster, and others) either are entirely independent of fibroids or entirely harmless *unless they produce symptoms*. If they are independent of fibroids they cannot be truthfully construed as having any significance in the treatment of fibroids, and if they are serious enough to deserve consideration they will occasion symptoms and this will lead to operation.

At first sight the mortality from operation, which in good hands will not average more than 3 per cent., would seem to indicate operation in view of the fact that 5.2 per cent. of the cases of fibroids (as given by Noble) are complicated by malignancy. Several things, however, must be considered before jumping to this conclusion. Were the series of cases reported by Noble and other authors consecutive, and did the series include every case operated upon whether it was of pathological interest or not? For example, if one were to compute the frequency of

degenerations and malignant complications in fibroid tumors from cases sent to the laboratory alone the results might be very misleading. Very often, unless every specimen is routinely examined, only the grossly diseased or the degenerated specimens will find their way to the pathologist. It is clearly evident, therefore, that statistics in this respect are only reliable when every case operated upon within a given time and consecutively is included. In my own cases of fibroid tumor at the University Hospital alone, which number one hundred and fourteen, and everyone of which has been thoroughly examined, there has been a lower percentage of really serious complications than those given by others. It is begging the question to inclued appendicitis, pregnancy, prolapsus of the uterus, retroposition, dermoid cysts, etc., as complications of fibroid tumor.

In my one hundred and fourteen cases there was but 2.6 per cent. of malignancy. As regards adnexal diseases in but 9.6 per cent. was there any condition which would have been of serious moment in the duration of the patient's life. There was gross degeneration of the tumor in eleven cases. Certainly degeneration which is only recognized microscopically and consists of hyaline areas is of little importance. I believe that in almost every myoma if serial sections were made, in some part hyaline changes would be found. As a result I must conclude that the importance of the degenerations and complications has been overestimated; that the cardiovascular system is affected directly in proportion to the extent of anæmia present; that myomata which are of moderate size and rate of growth may be let alone if they produce no symptoms; that serious hemorrhage, anæmia, pressure effects, rapid growth, and huge size call for immediate operative interference.

Uncomplicated Varicose Veins of the Female Pelvis.—Miller and Kanavel[1] undertook a study of varicose veins of the broad ligament in order to discuss the following propositions:

1. Are there cases of this disease, uncomplicated by any appreciable pathological condition, which give rise to a distinct syndrome demanding interference?

2. Can uncomplicated varicose veins of the broad ligament produce symptoms that may be attributed erroneously to other conditions and hence lead us to operate under a mistaken diagnosis?

3. The possibility of rupture and severe hemorrhage.

4. When varicose veins of the broad ligament are associated with other gross pelvic lesions, what relation do they bear to the symptoms and treatment of the condition?

5. Have the reported cases borne out the surgical assumption of Dudley, that this condition is analogous to varicocele in the male?

[1] American Journal of Obstetrics, April, 1905, vol. li., No. 4, p. 480.

Varicose veins of the broad ligament are usually passed over with the assumption that they are secondary, and that upon correction of the causative lesion they will disappear. Again they may be overlooked because they do not manifest themselves with the patient prone or in the Trendelenburg position. Thus many cases are probably accidentally and unwittingly cured by the ablation of the veins which results from the removal of the tube and ovary for other diseases. Hence it is that it is not regarded as a particular source of suffering. In considering the subject along the lines mentioned, only those cases should be studied in which there is no gross lesion of the pelvic organs which could be the direct cause. Such instances are known as primary varicocele; the ones complicating gross pelvic lesions are secondary.

The anatomical peculiarities of the left ovarian vein correspond to the left spermatic vein in the male. It enters the renal vein at a right angle. The pressure of the sigmoid flexure, when loaded with feces, may act as a predisposing factor of varicose veins. A prolapse of the left kidney with thickening of the veins is said to act in the same way; This is unlikely, for were it the case, varicosities would frequently be observed upon the right side in view of the comparative frequency of ptosis of the right kidney. The periodic monthly engorgement of the uterus and the adnexa, and the distention of the veins during pregnancy, are predisposing factors. In the fourteen primary cases which the authors found, there were thirty-three labors and twelve abortions, an average of two and a half labors and one abortion in each case. In several cases, it is definitely stated that the symptoms dated from childbirth; they almost always followed the last childbirth one to five years; there were but two cases in nullipara. Infection of the uterus after childbirth, abortion, and subinvolution, will help to produce a persistent engorgement of the ovarian veins. The large vascular sinuses at the sides of the uterus are favorable atria for infection which easily extends to the ovarian vein, producing a phlebitis and a secondary dilatation, as observed in the femoral vein; or again, contraction of the connective tissue in the pelvis following cellulitis may offer an effective barrier to the free return of the blood in the ovarian veins. Infection occurs most commonly in the left side. One cannot say whether the preponderance of left-sided varicocele depends upon anatomical relations or upon infection which show a predilection for this side. It is to be noted that in twelve cases of primary varicocele, six occurred upon the left side alone; in six it was bilateral; in no case did it affect the right side alone. Diseases producing general passive congestion, such as organic heart disease, are possible causes.

The condition of varicocele is described by Kelly as follows: "The ovarian veins were found enormously dilated, appearing as large, blue,

tortuous, distended vessels, extending from the uterine extremity of the tube outward under the hilum of the ovary to the infundibulopelvic ligaments." The varicocele may be associated with varicose veins elsewhere. Thus Cruveilhier reports an autopsy where the round ligament veins were markedly dilated. In Kanabel's case there were varicose veins of the vulva and hemorrhoids. Both of Malin's cases had varicosities of the veins of the legs and the thighs, and hemorrhoids. Zinke and Brandt have found phleboliths. The circulation of the ovary is affected and undergoes cystic changes; in seven of the fourteen cases one or both ovaries were the seat of small cysts. Cases have been reported of the rupture of varicose veins in the broad ligament. Many cases are reported without positive proof. There are but four cases, in which the diagnosis is fairly positive. In only one, that of Le Cerc, is there an authentic instance of a rupture of varicose veins, uncomplicated by any other conditions. The symptoms of varicocele of the broad ligament include:

1. Disturbance of menstruation which is apt to be prolonged, very profuse, and frequent. In a case of Pozzi the hemorrhage was severe enough to lead to the diagnosis of fibroid.

2. Sense of fulness, weight, and tension in pelvis, present or increased on standing, walking or exertion, and relieved by the reclining position This symptom was so distressing in Case I. of Dudley's that the patient could sit up but three hours daily, and Case II. was confined to bed for twelve weeks. Lumbar pain is mentioned in two cases; leucorrhœa in four. There are probably many cases in which symptoms are not present, just as in the male. Some of the cases reported were found at operation performed for other lesions. In some the previous history is not detailed. Dudley was the first to diagnose this condition previous to operation; he palpated the veins, per rectum, with the patient in a standing position. In one of his cases "rectal examination showed a mass of veins palpable on the left side; palpable also through the vagina but not as veins, only as a mass." In another case "the broad ligaments felt boggy, thickened, and tender." The same bogginess has been noted by others, but its significance has not been appreciated and wrong diagnoses have been made. A subinvoluted uterus is usually present; the cervix being noted as enlarged in four cases and the uterus in three. Hemorrhoids, varicose veins of the vulva, and a deep bluish tint of the mucous membrane of the vagina, are sometimes noted. The patient is usually multiparous. The symptoms of rupture do not differ from those of ruptured ectopic pregnancy. The indication for treatment is identical. The surgical treatment consists in ligating the veins in two places; at the uterine horn and at the outermost part of the broad ligament, opposite but not beyond the ovary, lest its circulation be impaired.

Excision or at least division of the veins between the two ligaments should be practised. Care should be taken in tying the veins, as they are very friable, lest the ligature should cut through, giving rise to embarrassing hemorrhage as in the case of Michel and Bichet.

The disease is clinically curable. The results of operation are best demonstrable in the cases of uncomplicated varicose veins in which nothing is done beyond a simple ablation of the veins. There are four such cases and in each a cure is reported.

Treatment of Complete Tear of the Sphincter Ani.--Kelly[1] has treated twelve cases of complete tear, of the sphincter ani, upon a new plan. It consists of almost complete withdrawal of food for ten days to two weeks following operation. The bowels are not moved for a period of ten days or two weeks. In the cases reported, the method of repair usually included the formation of an apron of tissue from the vagina, in order to avoid passing sutures from the bowel. The most suitable diet is egg-albumen alone. In some of the earlier cases the diet was occasionally varied with a half-ounce of beef-juice or chicken-broth, or two ounces of peptonoids, but it soon became evident that the patients did best and that there was less difficulty with the bowels, on albumen alone.

The total amount of albumen taken by a patient during a period of ten days is one quart and thirteen ounces. The amounts average as follows: first day, nothing; second day, 12 drachms; third day, 24 drachms; fourth day, 36 drachms; fifth day, 48 drachms; and from the fifth day to the tenth day, 48 drachms or 6 ounces daily, making a total of 45 ounces or one quart and thirteen ounces in ten days.

The bowels are moved at the end of ten days by giving a half ounce of licorice powder, followed in some cases by an oil enema, and perhaps by a half ounce of salts. The most important factor in securing the first evacuation is to have the patient lying on the side in Sims' position, so as to obviate straining. The evacuation is received in a kidney-shaped or a triangular basin, or in cotton. As soon as the bowels have moved broth, beef-juice, and wine-jelly are given for twenty-four hours, then a soft-boiled egg and creamed sweet-breads; after this, bread, toast, and soup.

Kelly keeps the patient in bed for eighteen days. This plan of treatment requires moral courage, as the patient begs and even cries for food. All of Kelly's cases were difficult ones.

He suggests that surgeons give closer attention to this plan of a restricted diet, limited to Nature's most highly concentrated nutriment—egg-albumen—which leaves almost no ash in the bowel. It may prove of value, he thinks, in the various forms of indigestion met with in surgical

[1] Starvation and Locking the Bowels for from Ten Days to Two Weeks. Surgery Gynecology and Obstetrics, February, 1906, vol. ii., No. 2.

work; it will surely be of value in all plastic operations on the intestinal tract. He has recently used it with great benefit in reducing the flesh of a very stout woman who had an umbilical hernia. It may prove of value in treating hysterical patients, as an adjuvant to those other forms of treatment which we use, in our efforts to aid the patient to strike a new balance with her nervous system. One thing is sure, nutrition must be profoundly affected, and when Nature's cry for more food is answered, massage, cold douches, or sponges, followed by active exercise, may succeed in diverting nutrition into old, unused channels, and so build up the nervous system.

Gonorrhœa. Little has been written that is new concerning the pathology of gonorrhœa, during the past year, at least so far as it appears in the adult. Holt[1] has published a most instructive paper on the disease as it affects young children.

Gonococcus Vulvovaginitis in Children. 1. Gonococcus vaginitis, he says, is a very frequent disease and one constantly to be reckoned with in institutions for children. It is also very frequent in dispensary and tenement practice, and not uncommon in the higher class of private practice. In eleven years at the Babies' Hospital, New York City, there have been two hundred and seventy-three cases. In three other institutions, among two hundred and thirty-three children examined, the gonococcus was found in twenty; in forty-three others there was a vaginal purulent discharge. A considerable number of the latter if repeatedly examined would eventually show the gonococcus.

2. In its milder form and in sporadic cases, it is extremely annoying because it is so intractable; in its severe form it may be dangerous to life, by producing an acute gonococcus pyæmia or an infection of the serous membranes; in its epidemic form it is a veritable scourge.

Four of Holt's cases developed gonococcal arthritis. There were no instances of endocarditis, pericarditis, peritonitis, or proctitis. In well-marked cases of gonococcus vaginitis in young children, the symptoms are fairly easy of recognition. The discharge is moderately abundant, of a yellow or a greenish-yellow color, and occasionally tinged with blood. In the milder cases, the discharge may be so slight as to escape observation except by close inspection. In such cases if careful attention to cleanliness is practised the disease may remain unnoticed for a long time. The detection of the disease is facilitated by placing between the labia a fold of gauze upon which the yellow discharge can be readily seen. Constitutional symptoms are very few and insignificant. Even in severe forms the temperature seldom goes above 101°. One of its

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[1] Gonococcus Infections in Children with Especial Reference to their Prevalence in Institutions and means of Prevention. New York Medical Journal and Philadelphia Medical Journal, March, 1905, vol. lxxxi., No. 11 and 12, p. 521 and 588.

most troublesome features is its intractability; frequently cases of but moderate severity would continue for six or eight weeks, in spite of constant local treatment. One of the greatest difficulties is the use of proper local measures in these very young patients.

The infectious nature of the disease may be shown by the fact that three cases in the year 1901, which were sent to a summer cottage from the Babies' Hospital, caused an epidemic which spread, in spite of precautions, to twenty-two other children. Similar epidemics occurred in the years 1902 and 1903, after the occupation of new hospital wards and in spite of every precaution.

As to the means of dissemination, Holt says that in children under three years of age direct contact, sexual or through the hands, plays no part. The most obvious way was through the medium of napkins. In the Babies' Hospital it had been their custom to soak the napkins in the disinfectant, boil them in suds and put them through a steam sterilizer. Thermometers, nipples, and bottles were kept separate with the greatest care. Sponges were abolished and absorbent cotton used for bathing purposes was immediately destroyed. Bathing in tubs was interdicted, yet the infection spread and there was only one explanation: the nurses carried the infection.

The highly contagious character of gonococcus vaginitis makes it imperative that children suffering from it should not remain in the same wards or dormitories with other children. A similar danger, though less in degree, exists with gonococcal ophthalmia and acute gonococcal arthritis or pyæmia.

It is practically impossible to prevent the spread of the disease if infected children remain in the wards with others. They must either be excluded from the hospital or, if admitted, immediately quarantined.

In the light of his experience, Holt says two things are essential: First, cases of gonococcus vaginitis must, so far as possible, be excluded; second, if admitted by accident or otherwise they must be quarantined. In excluding cases, but one thing can be depended upon, and that is the microscopic examination of smears from the vaginal secretion before the child is received. Holt has had this rule followed for nearly a year in the Babies' Hospital, and it has practically ended their difficulties. Certain cases, he says, can no doubt be recognized without a microscopic examination, but there are many others in which this is impossible. Mothers or others desiring the admission of children frequently bathe them carefully before applying, especially if they have been refused admission elsewhere because of the discharge. Again, the milder forms cannot be detected by a gross examination. Not only cases with much pus and the gonococcus must be regarded as dangerous, but also those with little pus and the gonococcus; and as very suspicious and requiring

the closest kind of attention, cases with a moderate number of pus cells, even though no specific organism is found.

When children are isolated the quarantine must extend to their nurses and attendants. Not only the day nurses, but also the night nurses should be kept from other children. On no account should the napkins, underclothing, or sheets from infected children go into the general laundry of the institution. The duration of the quarantine is difficult to fix accurately. It is not enough to continue it until all inflammation has subsided and a single negative examination for the specific organism has been made; such children must be watched for two or three weeks more or even longer.

Napkins should be worn by all children who have gonococcus vaginitis, no matter of what age, in order to prevent infection of the hands and thus a transference of the organism to the eyes or other parts. For bathing purposes, wash-cloths, sponges, etc., should be abolished and only absorbent cotton, gauze, or muslin used; the pieces of the latter after using must be immediately destroyed. No tub-baths are permissible. Each child should have its own towels and napkins, and these should be thoroughly disinfected after using. The most scrupulous precautions should be taken with reference to the nurses' hands; not only on account of the danger to herself, but also lest she may spread the disease in cleansing the mouth, or in handling the nipples of the feeding bottles. It is hardly necessary to state that the system of feeding should be such that there is no possibility of the same nipple being used by different children. After an outbreak in a ward, a general fumigation should be carried out just as extensively as after diphtheria or scarlet fever.

IDENTIFICATION OF THE GONOCOCCUS. McMonagle[1] raises the question, with regard to vulvovaginitis in children, whether the diplococcus observed can be differentiated from the gonococcus of adults. Robinson in examining the discharges in fifty-four children under five years of age, found the gonococcus in 67 per cent.; but it seems difficult to believe that the percentage should be so high. The vulvovaginitis of children is a difficult subject of investigation, but probably gonorrhœal and nongonorrhœal occur, and as McMonagle points out, other diplococci simulate the gonococcus, such organisms liquefy gelatin, while the gonococcus does not grow on gelatin nor will it liquefy blood serum. The cultivation test of the gonococcus is of great value in diagnosis and should be applied if possible. As regards the gonococcus itself, it is a diplococcus with a refractile envelope, generating by fission; it varies much in size, but neither form nor size are reliable guides in its recognition, as ill-developed gonococci may sometimes be found. Generally gonococci

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[1] Some Remarks on Gonorrhœa in Women. California State Journal of Medicine, San Francisco, March, 1905, vol. iii., No. 3, p. 81.

are found lying free, either as colonies or as separate and distinct diplo-
cocci, but never forming chains. They may surround the pus cells or
lie upon its surface, but the greater number are actually contained in
the pus cells, which with the epithelium are destroyed. Fuchsin is prob-
ably the best stain, while Gram's is not necessarily a conclusive test.

Wood[1] says cultural proofs for the isolation and the identification of
the gonococcus are so complicated and difficult of execution that they
must be left to the trained bacteriologist. The practitioner must always
depend upon the morphological identification of the organism in smears.
He has been accustomed to take advantage of the sharp morphology
of the organisms when stained by means of the Jenner blood stain. The
smears should be very thinly spread and as soon as dry stained for three
minutes. When the smears are from a case of gonorrhœal infection, it
is usually very easy to find the characteristic organisms in the bodies
of the leukocytes. The Jenner stain gives an especially good differen-
tiation because the cell bodies stain reddish, while the gonococcus takes
a deep blue stain. It is important, however, to remember that other
cocci assume a biscuit shape and occupy a position within the leuko-
cyte. This is especially true of the micrococcus catarrhalis, which has
been found in the urethra. These organisms, however, are usually
larger than the gonococcus. It is advisable to keep some stained
smears containing undoubted gonococci to control the microscopic find-
ings. The micrococcus catarrhalis is also negative to Gram, so that
this procedure offers no differential points. If after some search organ-
isms are found which are in pus cells but which do not correspond to
the morphology of the gonococcus, it is convenient to stain by Gram's
method on top of the Jenner preparation. The position of the doubtful
cells is marked on the co-ordinates of a mechanical stage, or the slide
can be marked with water-proof ink. After fixation of the slide by heat,
the Gram method is carried out in the usual manner. The same group
of organisms may then be re-examined and their relation to the Gram
stain determined. This method is more convenient than using Gram's
stain at first as it is easier to locate the organisms.

TREATMENT OF GONORRHŒA. Any innovations in the treatment of
this affection are worthy of consideration. At best the treatment has
been more or less unsatisfactory, at least as regards a permanent cure.

Lactic Acid Injections. Chandler[2] claims to have excellent results in
treatment of chronic cervical gonorrhœa by the injection of lactic acid.

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[1] Transactions of the New York Academy of Medicine, Section on Pediatrics,
meeting of March 2, 1905. American Journal of Obstetrics, April, 1905, vol. li., No.
4, p. 552.
[2] Lactic Acid in Gonorrhœa. Journal of the American Medical Association, October
7, 1905, vol. xlv., No. 15, p. 1071.

After thoroughly sterilizing the vagina and the vaginal cervix, the pure lactic acid is injected by means of a hypodermic syringe, into the tissues just beneath the mucosa; a few drops are injected at a time and the entire cervix (canal) is treated. This may be done at one sitting, or if the patient be nervous, at several. The lactic acid in these cases destroys the cervical glands and this is necessary in order to effect a cure. Chandler reports thirty cases which he claims to have cured (five to eight months' observation) in this way. From one to three applications were required.

Thermocauterization. Hunner,[1] after reciting the difficulties experienced in the treatment of *leucorrhœa*, says that leucorrhœa from a chronic inflammation of the endometrium is rare, whereas cervical leucorrhœa is one of the most common of symptoms. In every case of leucorrhœa the origin should be fully determined before any treatment is instituted. When the disease is localized in the cervix and has become chronic there, Hunner believes it is best treated by destroying the cervical glands. This he accomplishes by making radical incisions from the cervical canal into the depths of the mucosa with a cautery knife. In describing the technique of his operation the author says that one great advantage of this method is that it may be applied in office practice without administering anæsthesia of any kind. With the patient in the dorsal or lithotomy position, a broad-bladed Sims speculum is introduced into the vagina; the anterior lip of the cervix is firmly grasped with a tenaculum forceps, and the cervix is pulled down as near the vulvar orifice as possible. The nurse or the assistant stands by with the cautery already heated. On transferring the cautery to the operator, the nurse continues to work the cautery bulb with one hand while she holds the Sims speculum with the other. The operator retains the tenaculum in one hand and manages the cautery with the other. The strokes should be made one at a time, the cautery being removed from the vagina at each stroke, as the patient feels the radiated heat on the vaginal walls. The patient is warned that she will feel the heat, but that she must not move as there will be no actual pain. An exception to this rule is found in those patients who are suffering from a painful cervical scar. This condition is rare, and when present Hunner uses preliminary anæsthesia by applying for ten minutes a tampon soaked with a 20 per cent. solution of cocaine. He has relieved two cases of painful scar by this method.

The number and the depth of the radical strokes depend largely upon the condition of the cervix, but generally five or six strokes are made at each treatment, and the burns reach to a depth of 2 to 5 mm., or roughly, from one-eighth to one sixteenth of an inch. The length of the stroke

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[1] The Treatment of Leucorrhœa with Actual Cautery. Journal of the American Medical Association, January 20, 1906, vol. xlvi., No. 3, p. 191.

naturally varies with the conditions present, but it should extend beyond the area of the hypertrophied cervical mucosa. The treatments are given once in three weeks. A sterile strip of gauze is left in the vagina on account of possible hemorrhage. The patient is instructed to withdraw this the next evening, and she is warned that the leucorrhœal discharge during the first week or ten days will be more profuse than ever, and that she may have some slight bleeding. She is told to go to bed and remain there if the bleeding is at all profuse. Hunner has not known hemorrhage to take place the day of treatment, but there is often a little hemorrhage after three or four days, when the necrosis of tissue is at its height, and in one or two instances this hemorrhage has been sufficient to alarm the patient. A daily douche is recommended during the interval between treatments. The usual number of treatments ranges from three to six, and the greatest number he has given any patient is ten. The chronic gonorrhœal cases are the most obstinate ones, it being necessary to destroy all of the deep cervical glands before the leucorrhœa ceases. Another important consideration in gonorrhœal cases, says Hunner, is that the leucorrhœal discharge may be greatly diminished and yet not entirely stopped. In other words, the cervical catarrh may be cured by the cautery, but leucorrhœa may continue more or less profuse because of the endometritis and the metritis, which are the sequelæ of an ascending gonorrhœal infection. Many gonorrhœal infections do not gain a foothold above the cervix, and some which go higher are taken care of by Nature and leave no permanent lesions beyond the cervix. These cases may be classed as curable by the cautery method. The quickest and most brilliant results are obtained in the cases of cervical hypertrophy and eversion of the mucosa, due to multiple childbirth.

In regard to the influence of the scar tissue in the cervix, of necessity produced by this method, Hunner believes enough healthy stroma is left to prevent anything like the scar following amputation of the cervix. Two of his cases which went to term had normal labors. The author warns against the use of his method in the acute stage of cervical gonorrhœa; it is only after the persistence of leucorrhœa beyond twelve weeks and when the discharge is seen to come from the cervix, and there are no pelvic inflammatory lesions, that he begins cautery treatment.

Oil of Cloves for Sterilization of the Hands. Webster[1] in an effort to obtain a more satisfactory sterilization of the hands and arms has employed unrefined oil of cloves. He thinks it quite evident that an antiseptic to be efficient must be capable of penetrating the skin. Furbinger first pointed out the necessity of dissolving the fatty material in

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[1] Hand Sterilization with Special Reference to the Use of Oil of Cloves. American Journal of Obstetrics, April, 1905, vol. li., No. 4, p. 433.

the skin in order to allow the antiseptic solution to act, and he intro-
duced alcohol for this purpose.

Webster's method is as follows: The hands are scrubbed for five
minutes with any good soap and hot water, the latter being frequently
changed. A boiled stiff brush is used. The skin is then dried with a
sterile towel and rubbed for one minute with alcohol in order to remove
any remaining moisture. When it is dry the clove oil is rubbed into
the skin for four or five minutes and afterward washed off with the
alcohol. Occasionally there is a disagreeable burning sensation, but
never any injury. This unpleasantness is usually more marked when
the alcohol used is considerably below the absolute strength. The hands
thus cleansed are thoroughly rubbed with sterilized talcum powder and
covered with smooth, dry, rubber gloves which have been boiled for
fifteen minutes. Webster objects strongly to the use of wet gloves, because
the hands become macerated, and if an injury to the glove is undetected
during the operation, the softened skin may more readily yield organisms
which have not been destroyed, and these may contaminate the patient.
When the dry method is adopted the skin of the hand is the same at the
end of the operation as at the beginning. It is very smooth, the sterile
talcum powder having been rubbed into all the irregularities. An operator
should wear gloves of medium thickness, which are made from a model
of his hands. In this way a perfect fit is obtained. If the material is
too thin it is easily ruptured.

DISEASES OF THE BLOOD, DIATHETIC AND METABOLIC DISEASES. DISEASES OF THE SPLEEN, THYROID GLAND AND LYMPHATIC SYSTEM.

By ALFRED STENGEL, M.D.

THE BLOOD.

Pernicious Anæmia. ETIOLOGY. During the last year there has been considerable activity in the study of this disease. The work has been chiefly directed toward the relations of the supposed toxæmia, the blood and the gastrointestinal tract, the specific reactions of the bone-marrow and the significance of achylia gastrica. As before, all cases of anæmia showing a relatively greater decrease of red corpuscles than hemoglobin have been styled as progressive pernicious anæmia, but the tendency seems to be more and more to exclude those cases which have a demonstrable cause. The general opinion is that we should apply this term only to idiopathic cases. The advances made are chiefly in excluding those cases due to a readily discoverable cause. It is interesting to note that the cases of true idiopathic pernicious anæmia are quite uniform in their manifestations.

Although granting that we have made little or no headway in the treatment of grave anæmias, Brooks[1] makes some suggestions which are valuable. He advises that a case of persistent grave anæmia be considered from every aspect after a thorough examination of its individual features, the result of which, with the impartially viewed laboratory report, will indicate the treatment. He thinks the results of technical difficulties are sufficient to repay for the time and trouble. He says that hygienic measures may be expected to give better results than drugs alone. By following these suggestions we may add to the now considerable number of cases stricken off the list of idiopathic anæmias. The question of their mutual relationship has not been lately discussed in the literature, but from the similarities in clinical and pathological course, idiopathic and secondary or symptomatic anæmia may be found to have a common cause.

[1] Medical News, October 28, 1905.

When one considers the cause of these anæmias, the prominent opinion expressed by writers of the year is that there is a circulating toxin in the blood of the idiopathic cases, the origin of which is at present unknown. In those cases due to intestinal parasites much of the evidence is favorable to the view that the anæmia is caused by the absorption of a poison produced by the parasite. Thus for instance, Stevens[1] reports a suggestive case of pernicious anæmia, caused by the hook-worm; Meyer[2] ascribes to the dibothriocephalus latus the property of producing a toxin which may be absorbed and cause hæmolysis. Pomeroy[3] believes this theory to be substantiated by the frequency of intestinal disturbances observed clinically. Although this be true, there is not necessarily any gross lesion in the alimentary canal, for Faber and Bloch[4] have shown there is no atrophy, or indeed any other change in the mucous membrane of this tract; nevertheless, they think that this does not preclude the probability of absorption of a toxin. While achylia gastrica may be frequently associated with pernicious anæmia there is no reason to think that they are mutually interdependent, but rather that they have a common etiology. Bunting,[5] for instance, says that very few cases of primary achylia gastrica are followed by pernicious anæmia; and Martius[6] found no change in the stomach of a patient who had shown a marked achylia during life. Grave anæmias of the pernicious type occur in the puerperium and sometimes in association with syphilis, under which circumstances the theory of intestinal intoxication would have to be modified by assuming that there is an altered metabolism, but Faber and Bloch say in the above mentioned article, that the metabolism is little if at all affected. In such cases we are as much in the dark as ever.

According to Bunting, Thompson, and Pomeroy social conditions have nothing to do with the disease, indeed the well-to-do classes are the more often affected. The years between thirty-five and sixty show more cases than years outside these limits. The earlier reports have indicated a greater number of cases in women but more recent ones show the reverse, especially if we exclude those occurring during pregnancy and the puerperium.

The general course has been found by Thompson to be very uniform in his examination of fourteen cases.

To use the words of Bunting, "As to the secondary anæmias in the present state of our knowledge of pernicious anæmia, it seems

[1] California State Journal of Medicine, No. 2, 1905.
[2] Medical News, April 8, 1905.
[3] Ibid., April 18, 1905.
[4] Beitrage zur Pathologie der Verdauungsorgane, No. 1, 1905.
[5] Johns Hopkins Hospital Bulletin, June, 1905.
[6] Medical Klinik, No. 1, 1905.

impossible to say whether we are to assume that in some stage any severe anæmia may give rise to the picture of pernicious anæmia, or whether we may expect to find a common as yet undiscovered cause for both the idiopathic and symptomatic groups. However that question may be decided, one seems justified in assuming that the so-called idiopathic cases which show such uniform symptoms and blood findings, so similar a course and termination, are entitled to a position as a clinical entity, and that one may hope to find for them a single cause—and this disease we may explain in Cabot's words with a slight modification as a profound anæmia, almost invariably fatal without adequate known cause, characterized by an extreme diminution of the red blood corpuscles and usually by other changes in the blood, indicative of a pathological method of blood formation, as well as absence of emaciation and a tendency to spontaneous temporary improvement followed by relapse." The tendency to remissions is said by Thompson to be due to corresponding stages of activity on the part of the parasite when such a factor is responsible for the disease, or to naturally varying ability to resist on the part of the patient, whatever be the exciting cause.

No assistance in explaining the cases beginning in the puerperium has been offered by the work of the year. Gilbert[1] reports a case in which the symptoms first appeared two weeks after delivery, improving slowly under treatment during five weeks. The patient did not seek medical advice until three months after the first noticeable indications of illness. Suddenly and without discoverable cause, she was taken with a series of syncopal attacks and died. There were no indications of embolism or uræmia; no autopsy was permitted.

As to the bone-marrow, Bunting[2] shows that there is a distinct reaction on its part to the toxic agent. He believes that the poison has a hemolytic effect on the red cells in the circulating blood and in the bone-marrow. By bleeding rabbits he found that the simple loss of blood caused the hematopoietic organs, notably the marrow, to supply new cells hurriedly, some of which were naturally nucleated. But if he injected a known hemolytic poison frequently, the result was that there was a destruction of hematoblasts as well as the red corpuscles ready for distribution into the blood. In order to fill up the deficiency hastily the marrow is compelled to discharge the embryonal type of cell into the circulation. Therefore, as he emphasizes, the greater the number of megaloblasts in the blood the more advanced and more grave the case.

His studies showed that megaloblasts are normally present in the bone-marrow, which is contrary to Ehrlich's teaching.

The theory of a circulating toxin with a hemolytic effect is accepted

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[1] Colorado Medical Journal, vol. ii., 1905. [2] Loc. cit.

by Lannois and Weil[1] who say that there is in addition an invigorating action on the white cells; and Payem[2] who insists that the injury to the hemoblasts is permanent.

Arullani[3] reports a case caused by the *micrococcus tetragenus*. Inasmuch as the coccus was cultured from the finger blood and urine during life and from the chyle at autopsy, and produced the same effects upon animals as were exhibited by the patient, the reporter believes it to have been the cause of the disease. During the three months the case was under observation, phlebitis of the legs and a cholera-like diarrhœa appeared as complications. It may be properly observed in connection with this case that septicopyæmias of various kinds at times simulate pernicious anæmia.

Techemolosoff[4] adds two more cases to his first four of pernicious anæmia with retinal hemorrhages due to the anchylostomum duodenale. Despite treatment, both cases ended fatally. The microscopic examination of the eyes gave no satisfactory result. Retinal hemorrhages may in part depend upon the effect of the toxin upon the vessel walls. As will be discussed later there have been found small areas of myelitis beginning around end arteries in the cord, and Faber and Bloch seem to believe that this is due to the effect of the toxin on the vascular walls.

PATHOLOGY. Thompson, in the study of his cases at postmortem, mentions the frequent occurrence of small pial hemorrhages of a fatty and cirrhotic liver, and a few uncharacteristic changes, such as acute and chronic inflammation in the pancreas.

Kurpjeweit[5] describes his studies of the spleens of chronic congestion and acute tumor and of three cases of pernicious anæmia. He found in them beside the usual cells, eosinophilic, neutrophilic cells and nucleated red corpuscles which, according to Ehrlich, are only found in the bone-marrow. These cells were found in smaller numbers in the spleens of the first-named conditions. Nevertheless, Kurpjeweit believes that in these pathological conditions the spleen assumes at least a part of the functions of the bone-marrow. In entirely normal spleens these elements were wanting; nor were they found in the circulating blood, a fact which the investigator interprets as substantiating his opinion.

In considering the state of affairs in the alimentary tract we now have good proof that there is no atrophy of the mucous membrane. The injection of formalin into the gut immediately after death by Faber

[1] Rev. de Med., xxiv. No. 8.
[2] Med. moderne, No. 51, 1904.
[3] Gazz. deg. ospedalie delle clin., No. 85, 1905.
[4] Russky Vratch, ii, No. 48, 1905.
[5] Deutsches Archiv f. klinische Med., Bd. lxxx. Heft 1.

and Bloch showed conclusively that the integrity of the mucous membranes was well maintained, and that the previously conceived idea of an atrophy was erroneous. To be sure they found some atrophy in those cases not treated with formalin, which they ascribe to postmortem changes. They say that the mucous membrane both absorbing and secreting is entirely normal.

Evans and Halton[1] say, in describing a case which will appear under another heading (aplastic anæmia), that there is enlargement of the hemolymph glands with dilatation of their sinuses, deposition of pigment and increase in phagocytosis. This is also the case with the lymph glands themselves, a fact which is very seldom mentioned, and which these authors think is a very usual finding in cases of pernicious anæmia.

Clark[2] describes the *cord changes* such as occur in connection with grave anæmias as of two groups, viz., those secondary to the anæmia or dependent upon the same cause as that producing the anæmia, and those which present the same pathological lesions but are not attended with anæmia. He thinks there is enough evidence to separate the degenerations occurring in the cord in pernicious anæmia from similar conditions independent of that state of the blood, inasmuch as the anæmia is the first indication of the illness. Symptoms of cord disease are never pronounced but may be sometimes elicited when looked for; anatomically the lesion affects the posterior columns largely, and the lateral tracts only slightly, while the degenerations of the cord, independent of anæmia, namely subacute combined sclerosis and diffuse degeneration of the cord, are more extensive, restricted to marked divisions and chiefly affect the periphery from which they extend centripetally. The type of degeneration is the same. He also noted small hemorrhages in the gray matter which were not specific and had no relation to the degenerations. He considers these effects as of a toxic origin. On the other hand, Faber and Bloch viewed the nervous lesion as starting from focal points of myelitis beginning around small arteries. These spread and by their fusion cause tract involvement. The authors agree that the columns of Goll and Burdach are most commonly the seat of the degenerations. Van Wart[3] reports a case in which the blood picture was that of pernicious anæmia, to which were added marked ataxic symptoms. He made the diagnosis upon the blood picture despite the fact that the nervous symptoms appeared first and were quite indicative of a primary disease of the cord. He adds that the direct cerebellar and crossed pyramidal tracts may be attacked.

[1] Journal of the American Medical Association, April 15, 1905.
[2] Brain, Winter, 1904.
[3] Medical News, January 14, 1905.

The effect of the toxin on the blood vessel wall is not at present clear and the relation of one to the other still remains unsettled.

In regard to the toxin many authors believe that it emanates from the alimentary tract. As to its specificity writers disagree, some stating that it is a peculiar hemolytic poison. Such a view is maintained by Thompson, and probably justly, in reference to dibothriocephalus. He says that the injection of the proglottides of this worm produces a hemolysin truly specific and not found in the blood of uninfected animals. But in the blood of true pernicious anæmia, Litten and Michaelis[1] declare that there is no ground for the assumption that there is a complex hemolysin of the Bordet type, because they were unable to produce a solution of the patient's corpuscles by his serum, and this effect was also wanting with the corpuscles of healthy individuals. They think this does not speak for a loss of complement. Pernicious anæmia blood was sometimes seen to have an agglutinating effect upon the corpuscles of other people, an effect which is not specific.

SYMPTOMS. W. von Leube[2] says that *a positive centrifugal pulse* is sometimes noted in the jugular vein in cases of anæmia. It may be slight or pronounced, and is evidently the consequence of the functional insufficiency of the tricuspid valve, the result of anæmia. The origin is the same as that of relative mitral insufficiency in chlorosis. The symptoms in each case improve as the patient progresses toward recovery. The relative tricuspid insufficiency in anæmic individuals appears at the same time as the relative mitral insufficiency, thus differing from the tardily developed tricuspid insufficiency in the course of an endocarditic defect. This early association with mitral insufficiency and its persistence without severe disturbances in the circulation, are grounds for assuming the relative character of the tricuspid defect. A positive centrifugal venous pulse is also observed at times in anæmic subjects without signs of tricuspid insufficiency. In some of these cases at least this must be referred to a latent tricuspid insufficiency which may eventually become manifest.

There seems to be a tendency to *recurring vomiting*, for Thompson noted this in six of his fourteen cases, which gave no other indications of gastrointestinal trouble of any amount. He noted also a frequency of congestion of the lungs.

J. Müller exhibited before the *Kongress für innere Medizin* in Wiesbaden, some crystals found in the stools of a case of pernicious anæmia. They were soluble in warm water and could be strained by methylene blue and iodine.

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[1] Fortschritte der Medizin, No. 36, 1904.
[2] Zeitschrift f. klinische Medizin, lvii. Nos. 3 and 4.

Achylia gastrica is mentioned in a very few instances as accompanying this disease, but a distinct relation between this condition and some anatomical alteration in the mucous membrane of the stomach has been shown not to exist. Martius[1] observed a case most carefully and during life found absolutely no HCl and a very low total acidity (10). At autopsy there was no lesion of the stomach lining. This is another corroboration of the findings of Faber and Bloch who discovered that if they injected formalin into the stomach directly after death, the gastric mucous membrane was found to be in an almost normal state, and that when some atrophy was present it was of inflammatory origin. There was a diffuse leukocytic infiltration and frequently a cystic dilatation of the glands. They found no arterioles with any apparent disease of their walls, or surrounded by areas of cellular infiltration such as they met in the cord. This latter will be considered further on. These authors say that the anæmia and the changes in the gastric wall may have the same cause but they are by no means mutually responsible to one another, and that for the present the relations of these two conditions will have to remain unsolved. It may be that the gastritis is due to the excretion of the poison by the stomach, it being neutralized or rendered inert before reaching the intestine, if it pass downward. The finding of gastric atrophy at postmortem these authors think is due to digestion when acid and pepsin are present, and in their absence, to bacteria.

Sabrazes[2] calls attention to the fact that while the *coagulation time* of pernicious anæmia blood is not delayed, the retraction of the clot is slow and incomplete.

Leucopenia with a relative *lymphocytosis* is the rule. Eosinophilia is absent in the idiopathic cases and those due to the bothriocephalus, but it may be present in other parasitic infections. It is noticeable in the cases due to the bothriocephalus, that there is a marked lymphocytosis. Thus in Meyer's cases the lymphocytes were 68 per cent. and 54 per cent.; Weber and Furth's case had 78 per cent.

The disappearance of the symptoms in the cases reported by Meyer and Thompson after the removal of the parasite favors the idea of a soluble absorbable toxin, since if there were a distinctly altered metabolizm or hematopoiesis the results would be prolonged. Thompson says that the cases caused by the dibothriocephalus are not of a very grave type.

A new group reported during last year is a class styled "*prepernicious anæmia*" by Langdon.[3] There were a variety of symptoms comprising

[1] Medical Klinik, No. 1, 1905.
[2] Folia hematologica, No. 5, 1905.
[3] Journal of the American Medical Association, November 25, 1905.

general ill health, mental manifestations, various nervous phenomena, diarrhœa, with a yellow tint of the skin and a blood picture like pernicious anæmia. These patients exhibit loss of inhibition, peevishness, gradual mental deterioration which fluctuated in its degree sometimes in remarkably short periods. They further have dull aches and pains, at times in the joints, which, however, never assume a true inflammatory type. Numbness, tingling, and weight in the legs were also noted. Of the subjective sensory symptoms he mentions loss of tactile and pain sensation. Plus knee jerks, ankle clonus, and Babinski's sign were noted. Ataxia may be present. Diarrhœa of the mucous type comes later, to be followed by a lemon yellow tint of the skin. The author thinks that this symptom-complex is sufficient to establish a clinical entity with the name he has suggested. Wolfstein said, in discussion of this paper, that the adoption of this name would lead us into difficulties, and, moreover, these cases would be properly classified under one or other of the nervous degenerations, such as subacute degeneration of the cord. He thinks the clinical picture of pernicious anæmia is well enough established to diagnose it without supposing a precursory stage. My own view regarding the establishment of such refinements of subvariations is the same as Wolfstein's.

TREATMENT. Studies on the treatment of pernicious anæmia have emphasized the great usefulness of arsenic, especially in those cases dependent upon syphilis, where, according to Lannois and Weil,[1] mercury seems to do more harm than good. In these luetic cases iron and bone-marrow give no encouraging results. Naegeli[2] says that the effect of arsenic may be to stimulate directly the production of erythrocytes, or may be due to the greater amount of albuminous plasma which is enabled to reach the tissues by the effect of the drug on the vessel walls. The administration need only be discontinued when the gastrointestinal disturbances are very severe, or seem to be dependent upon its use. Naturally if the disease be caused by a parasite the indications are for its removal, after which arsenic is also demanded.

The use of HCl and pepsin in cases of achylia gastrica has met with no good results. If putrefaction be present, especially in the stomach, lavage and cleansing enemata are very beneficial and may be followed by nutrient ones. These latter are not, however, retained as a rule.

Naegeli suggests that the spontaneous improvements sometimes seen are due to an antibody, and we may hope in the future to make therapeutic use of this curious natural and yet unexplained reaction on the part of the patients.

Montries[3] reports the results of opotherapy on a patient with per-

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[1] Rev. de Med., xxiv. No. 8.   [2] Med. Klinik, No. 2, 1905.
[3] La Semaine medicale, No. 15, 1905.

nicious anæmia. The condition of the red cells and the symptoms referable to the anæmia were very markedly benefited by the marrow. The blood of this patient contained many myelocytes (5 per cent.). This author, as well as Mentrier, Aubertin, and Bloch,[1] emphasizes the benefit obtained by the use of bone-marrow in all cases which show a myeloid reaction, even when a mild myelæmia is present.

Aplastic Anæmia. The literature of this condition has been enriched during this past year by the reports of several cases. Zeri[2] reports two cases, one of which was observed eleven years ago. The second case occurred in a man of forty-six who came to the hospital on account of diarrhœa and a very evident anæmia. The blood examination revealed the following data: hemoglobin, 38 per cent.; erythrocytes, 1,423,000; leukocytes, 2700; color index, 1.36. There was a moderate poikilocytosis, leukocytosis, some microcytes and a few macrocytes. No nucleated red cells were found. The differential count showed: 43 per cent. of lymphocytes, 57 per cent. of polynuclear neutrophiles and transitionals, and no eosinophiles. An examination of the blood six weeks later showed the following: hemoglobin, 18 per cent.; erythrocytes, 411,000; leukocytes, 4000. The man died three months after the onset. At autopsy the following interesting conditions were found in the bone-marrow; that of the epiphysis and diaphysis of the long bones was yellow and fatty. In the marrow of the ribs there were numerous lymphocytes but a scarcity of polymorphonuclear leukocytes and mononuclear eosinophiles. Normoblasts with multiform nuclei were present. In the marrow of the shafts of the long bones there was proliferation of the connective tissue; no erythroblasts or erythrocytes were found.

It is unusual to find the color index so high in aplastic anæmias as it was in this case and also to find the percentage of lymphocytes so low relatively. Both of these elements occur more characteristically in a case reported by Evans and Halton[3] in which there were 10 per cent. of hemoglobin, 770,000 red blood cells and 2300 leukocytes with a color index of 0.65. At two examinations of the blood the lymphocytes constituted 90 per cent. and 91 per cent. of the whole, large lymphocytes 2 per cent., polymorphonuclears 6 per cent., and eosinophiles 1 per cent. No nucleated red cells were found and there were no polychromatophilia or poikilocytosis. Unfortunately the postmortem examination of this case was not sufficiently exhaustive to determine the changes in the bone-marrow. The absence of any evidence in the blood of an increased or pathological hematopoiesis seems to justify its inclusion in the class of the aplastic anæmias.

[1] Bull. et Mem. Soc. med. de Hop. de Paris, xxii., 315, 1905.
[2] Il Policlinico, 1905.
[3] Journal of the American Medical Association, April 15, 1905.

The case reported by Blumer[1] is interesting on account of its long duration, twenty-two months. This case presented the usual unregenerative condition in the bone-marrow.

A case under my own observation was interesting in presenting characteristic conditions of the blood and a wholly aplastic marrow. The case will be reported by Dr. Lavenson.

Splenic Anæmia and "Splenomegalie Primitive." As was detailed in last year's PROGRESSIVE MEDICINE the identity of this disease has been much confused, a condition which has not improved during the year of 1905. The nomenclature, and class of cases which have been reported under this name called forth from Naegeli[2] the criticism, that the cases of Griesinger were void of clinical uniformity and not supported by postmortems, while the case of Strumpell was pure pernicious anæmia. He moreover asserts that we have not at present sufficient data to decide that this disease is a clinical entity, since the only constant features seem to be an enlarged spleen and an uncertain type of anæmia. He takes issue with Senator, whom he quotes as saying that splenic anæmia is that form of pseudoleukemia which in its second stage becomes Banti's disease by the addition of cirrhosis of the liver. Senator,[3] however, defends his position in the following remarks: "I have not explained splenic anæmia as a precursor of *Banti's disease,* but rather that the latter is a second stage of the former as a combination of splenic anæmia with liver cirrhosis, which can appear, but does not under all circumstances. I have said that what Banti describes as the first stage of his disease does not differ from splenic anæmia. That does not mean, however, that the latter must be a first stage of the former. On the contrary I say, that since one does not know whether ascites or liver cirrhosis will be added in the further course of an anæmia splenica, so is the nomenclature anæmia splenica more certain and pertinent. Therefore Banti's disease is in' my opinion, a condition secondary to splenic anæmia, but this latter is not necessarily an early stage of the former." He moreover adds that this name should be retained because it has a composite meaning despite the fact that we know little or nothing in reality of the causation of the disease. It can have no relation to pseudoleukemia because of their different blood and pathological pictures, but clinically it is often very difficult to make the differential diagnosis. Notwithstanding the fact that the anæmia is greater and there is a secondary leukocytosis and myelocytosis in pseudoleukemia, who can say what the limits of anæmia are and whether there will be later changes in the white cells? A very mild anæmia with an enlarged spleen is sometimes observed

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[1] Bulletin of the Johns Hopkins Hospital, April, 1905.
[2] Folia hematologica, ii., No. 5, p. 327.   [3] Ibid., ii., No. 7, p. 487.

for a long time. He is of the opinion that we should call all idiopathic spleen tumors associated with anæmia, "splenic anæmia;" if lymphocytosis appear then we may be justified in suspecting an aleukemic stage of leukemia. Sternberg[1] supports Naegeli's view because the name only represents a symptom-complex and gives no idea of the real nature of the disease.

Simmonds and Umber[2] apparently believe it to be a disease "sui generis" because they observed that the metabolism was disturbed in cases of Banti's disease but not in cases of simple cirrhosis. Nevertheless they state positively that they cannot make the diagnosis postmortem. Their observations lead them to believe that the removal of the spleen is beneficial because it eradicates the source of a poison. In their case there was a cirrhosis of the liver and cirrhotic enlargement of the spleen; the bone-marrow was partly normal and partly hyperæmic.

d'Amato[3] concludes from his examination of two cases of *Banti's disease*, two of chronic malaria and one of syphilis, affecting chiefly the liver and spleen, that the cause of splenomegalic leukopenia cannot be sought in the distribution of the leukocytes in the different vascular regions nor in any leukotoxic action on the part of the blood serum. He ascribes it to the condition of the blood producing organs, especially the spleen and bone-marrow.

O'Malley and O'Malley[4] in discussing the cause of splenic anæmia state that while splenectomy favorably influences the course of this disease it by no means proves that the disuse of the spleen is the cause of all the symptoms. There is no evidence that there is an excessive hemolysis because of the absence of iron in the liver; the change taking place in this organ is one of cirrhotic atrophy. These authors hazard a guess that the spleen sends out a hemolytic ferment into the circulation. Inasmuch as Babbozzi found that the spleen takes hemoglobin from the red corpuscles as well as destroys them and that splenectomy renders the red cells less liable to lose the hemoglobin, and since Hunter found that toluylenediamin would cause no hemolysis after splenectomy, the authors question the probability that the hemoglobin would be more stable after the operation because there would be less destruction of red cells. They emphasize the pathological changes in the spleen in cases of true splenic anæmia in the following words: "Atrophy of the Malpighian bodies caused by overgrowth of connective tissue about the central artery or by ingrowth of fibrous tissue from the periphery; thickening of the capsule, trabeculæ, the walls of vessels and the reticular lining of spaces in the splenic pulp; proliferation of the endothelial

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[1] Folia hematologica, ii., No. 7, p. 487.   [2] Münch. med. Woch., April, 1905, p. 772.
[3] Zeitsch. f. klinische Medizin, lvii., Nos. 3 und 4.
[4] American Journal of the Medical Sciences, June, 1905.

lining of the splenic vessels and blood spaces of the pulp." It has been held by some that these proliferated endothelial cells are responsible for the hemolysis, because it is believed that the enzymes normally causing destruction of erythrocytes come from this endothelium.

The case of Brill, Mandlebaum and Libman[1] again opens the question of the difference between primary splenomegaly (splenomegalie primitive—Gaucher) and splenic anæmia. They say that the case was one of primary splenomegaly because of the enormous size of the liver and their pathological findings. It is the first case occurring in a male yet reported, and has the peculiarity of being the third case in the same generation of the same family. The spleen began to enlarge in 1889, decreased slightly at one time, after which it gradually increased in size. The enlargement of the liver was first observed in 1899. The blood was practically normal up to 1900. In August, 1900, the condition became worse and there was no let up in the symptoms to any degree, the fatal issue occurring in March, 1904. During the course of the disease the patient suffered with colitis, petechiæ, hemorrhagic furuncles, hemorrhagic diarrhœa, acute malaria, and a painful condition of the lower end of the tibia without any pertinent signs. The blood count in August, 1902, was: hemoglobin, 45 per cent.; erythrocytes, 3,420,000, and leukocytes, 8,240. The differential count was practically normal. In April, 1903, the hemoglobin was 55 per cent.; erythrocytes, 4,400,000, and leukocytes 5,240. Examination in September, 1903, showed the spleen to be very greatly enlarged, the liver to reach from the fourth rib to 4 cm. below the level of the umbilicus and extending below the iliac crest in the flank. This condition remained about the same for a while, the blood picture also being the same as before. The patient was suddenly taken with pericarditis of a hemorrhagic character with associated ecchymosis; then ascites followed, and was speedily succeeded by death. A yellow brown color of the skin of exposed parts had been present for some years. Fever had been almost continuously present and was quite varying in its degree. A feeling of well-being was experienced by the man, only interrupted at times of intercurrent infection. The autopsy revealed a firm, chocolate-colored, very much inlarged spleen weighing 5,280 grams and measuring 44 x 20 x 14 cm. The liver was of a reddish-brown color with white and dark brown mottlings and a few fine hemorrhages; it weighed 4.8 kilos, and measured 35 x 54 x 13 cm. The bone-marrow was firm and dark red in color.

Sections of the various tissues showed alveolar spaces, apparently lymph spaces, where the endothelial cells had proliferated, forming nests. The cells were large and had relatively small peripherally located nuclei. They were seen to grow from the lining of the lymph spaces.

[1] American Journal of the Medical Sciences, March, 1905.

They were found in the liver, spleen, kidney, lymph glands and hemo-lymph nodes. There was also a diffuse cirrhosis of the liver without injury to the liver cells. Hemosiderin was present. These large endo-thelial cells were to be seen among the liver cells themselves. When large clusters of these cells are found anywhere there was a fine connective tissue network about them. In lymphatic structures the lymphoid arrange-ment was largely destroyed. The bone-marrow also contained some of these endothelial elements but not in great numbers; smears showed abundant normoblasts, red blood cells, and poikilocytes; leukocytes were chiefly eosinophilic and neutrophilic myelocytes; some giant cells were also present. This is the only case which showed endothelial proliferation in the bone-marrow. Smears from the liver and spleen con-tained no nucleated reds, no myelocytes or giant cells.

The authors do not believe that this case should be classed with the splenic anæmias because of the endothelial nests, but whether these be neoplasms or not they do not commit themselves.

Sanford and Dolley[1] report a case with the title of splenic anæmia which recalls the remarks made in last year's PROGRESSIVE MEDICINE and the very pertinent criticisms of Naegeli quoted above. The case was of long duration with gastrointestinal disturbances and pain in the splenic region, recent severe hemorrhages by stool and vomiting after traumatism; secondary chlorotic anæmia without leukocytosis; no adenopathy; dislocated and enlarged spleen which was observed to become half again as large after an exploratory laparotomy. Then splenectomy was done but the patient succumbed seventeen days after. There were found dislocation of the spleen with torsion, great elongation and thrombosis (partly old and partly new) of the splenic veins; chronic passive congestion and fibrosis of the organ. No histological changes like those in primary splenomegaly were found; there was interlobular atrophic cirrhosis of the liver; chronic passive congestion of the rest of the portal circulation; compensatory hyperplasia of the hemolymph nodes; hyperplasia of the bone-marrow; and tuberculosis of the bronchial and tracheal glands. The authors believe that an early stage of splenic anæmia was strongly suggested by the patient's pallor, digestive disturb-ances and pain in the splenic region, symptoms which the history indi-cates as having been present for a number of years. The frequency of urin-ation and the pain in the splenic region would also imply a long-standing dislocation of the spleen. This is corroborated by the enormous elonga-tion of the splenic vessels. Whether or not the twists in the splenic stalk occurred at the time of the accident, it is impossible to say, but it is more reasonable to suppose that some had occurred previously and not all

[1] American Journal of the Medical Sciences, May, 1905.

at once, because of their number. The enlargement of the spleen seen after exploration was probably due to thrombosis, which is indicated by the lack of organization in these clots. They say, "If Banti's stage of splenic anæmia is limited to those cases in which the cirrhosis is a terminal affection, this case cannot be included in his category, for the cirrhosis of the liver is of certainly as long standing as the fibrosis of the spleen." They prefer to call this case one of splenic anæmia associated with cirrhosis, the latter not being dependent upon the former. The enormous elongation and torsion of the vessels associated with the dislocation of the spleen, possess a very probable etiological significance. The compensatory hypertrophy of the hemolymph nodes, the authors think, is due to their assumption of a part of the function of the spleen.

There is nothing in this history to prove the relation of the splenic tumor and its dislocation, to the anæmia. The authors admit that the pathological processes in the liver and spleen are probably of the same age. The case is rather more suggestive of an initial hepatic cirrhosis, the splenic condition being due to primary congestion and secondary trauma.

Levy[1] publishes the notes of twin sisters affected with splenic anæmia, one of whom died, the other being still under treatment. These two cases began about the same time and when the sisters were not living together, the course having been much more rapid (and was fatal) in the married woman than in the single one. The duration of the fatal case was four years, while the woman who is living has had symptoms referable to this disease for six years but has been under observation only four years. They both had a tendency to puffy, moderately tender superficial swellings, fever, pain in the left hypochondrium and ulcerative stomatitis. Leukopenia was marked in both, with a relative lymphocytosis. The spleen of the fatal case was very large and showed an increase in the reticulum, especially in the pulp; there was no endothelial proliferation. The liver seems not to have been enlarged.

The case which still lives has a very large spleen but no involvement of the liver. There is an absolute achylia gastrica, and digestion is quite incomplete. The leukocytes decreased in number when arsenic was used.

In O'Malley and O'Malley's[2] case the principal features were a high color index, a true hemoglobinæmia determined by the spectroscope, and shrinking of the spleen during observation. Permission for a splenectomy was only given when ascites had appeared and the boy succumbed a week after the operation. Section of the spleen showed a connective tissue hyperplasia, marked proliferation of the endothelium especially around the bloodvessels and in the sinuses, the latter

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[1] American Journal of the Medical Sciences, May, 1905.   [2] Vide supra.

being filled. The Malpighian bodies were visible and enlarged by the presence of the above-named cells.

The spleen in this case shrank 10 cm. from the middle of June to the end of October, but never receded behind the ribs. Such diminutons in the size of the spleen are not unusual especially in the cases in which large gastric hemorrhages occur.

The authors conclude from the literature that all cases are fatal if splenectomy be not performed, while the mortality is about 25 per cent. from the operation. They state what they consider the cardinal and determining *symptoms and signs* of splenic anæmia as the following: Splenomegaly, a progressive secondary anæmia with leukopenia, absence of external glandular swelling (abdominal glands usually enlarged at autopsy), notable chronicity and sometimes a protracted tendency to hematemesis; pain in the region of the spleen; pallor with a pigmentation of the skin; fever, nausea, vomiting, diarrhœa, epistaxis, bleeding from the gums; and rarely hemoptysis and hematuria. The spleen is enlarged and tender, and may have irregularities on its surface, especially when pain is present.

Withrow[1] reports a case of splenic enlargement of five years' duration, with a chlorotic anæmia and hemorrhages for one year. There was no enlargement of the liver. Constant and progressive improvement was observed under the use of arsenic, iron and strychnine.

Bramwell[2] reports a case of splenic anæmia, the features of which were a large spleen, without discoverable cause, chlorotic anæmia, a history of severe and repeated hemorrhages during three years; there were relatively great numbers of polymorphonuclear cells; the liver was not affected. By the use of the *x*-ray for six weeks, applied over the spleen, a marked decrease in the size of that organ was noted, with parallel improvement in the blood condition.

Sir Patrick Manson[3] in discussing the tropical splenomegalies, states that all cases of idiopathic splenic tumor which have had anything to do with the tropics should be examined for the Leishman bodies since the bodies found in the spleens of tropical cases and in "oriental sore" are the same morphologically. Splenic puncture is dangerous, but is a diagnostic help.

Basset-Smith[4] after a consideration of the relation of splenic anæmia and the infections in which the *Leishman-Donovan bodies* are found, comes to the conclusion that splenic anæmia is not due to any parasite, but belongs to that class of cases which come under the head of "tropical splenomegaly" in which the Leishman-Donovan bodies play an important part.

[1] Lancet-Clinic, April 15, 1905.   [2] Clinical Studies, October 2, 1905.
[3] British Medical Journal, November 11, 1905.   [4] Ibid.

Wooley[1] discusses the form of splenomegaly seen in the Philippine Islands and concludes that it is the same as the form seen elsewhere in the tropics. The disease seems to be characterized by frequent attacks of a remittent or intermittent fever resembling malaria, which is, however, uninfluenced by quinine. The spleen enlarges quite rapidly, reaching its maximum size at the second or third attack of the fever, after which little change occurs. If the liver enlarges, which is not always the case it is secondary to the spleen. Jaundice is often present without involvement of the liver, and to this pigmentation is probably due the muddy color so often seen. Hemorrhage into the skin and mucous membranes is also common. Œdema into the skin and viscera is sometimes observed. Anæmia, emaciation and cachexia gradually develop in most cases. Pain is not common and is especially noted in the early stages. This disease seems to behave like an infection.

Anæmia in the Aged. Kurpjuweit[2] describes two cases of fatal anæmia in old men. The cases differed from pernicious anæmia in their short course, continued high fever, considerable swelling of the spleen and the moderate reduction of the erythrocytes, the latter being disproportionate to the great paleness. The leukocytes were reduced considerably (the blood count showed 2,000,000 erythrocytes and from 1000 to 600 leukocytes). Nucleated red blood corpuscles and poikilocytes were absent. The marrow at autopsy showed very few specific cells.

Lefas[3] reports the finding of curious bodies in the blood of a woman of sixty. The case was very like pernicious anæmia otherwise. These bodies were seen in the red cells, the polynuclears or free in the plasma, but not in the mononuclears. They were round, sometimes oval and stained deeply with hematoxylin. Lefas says that the meaning of these bodies is not known.

Leukanæmia and the Anæmias of Childhood. Mattirolo[4] reports a case of leukanæmia which demonstrates very well both clinically and pathologically the involvement of the lymphatic and erythrocytic elements in this condition. The patient was a child of nine years showing clinically a painless enlargement of the cervical glands and a swelling of the faucial tonsils. Percussion over the long bones was painful. The blood count showed 20 per cent. of hemoglobin, red cells 900,000, and leukocytes 76,000; lymphocytes 51 per cent., many neutrophilic myelocytes and transitional forms. The polynuclear forms were nearly exclusively neutrophilic. Poikilocytosis, anisocytosis, normoblasts and megaloblasts were present. At autopsy general lymphoid hyperplasia

[1] Johns Hopkins Hospital Bulletin, January, 1906.
[2] Deutsches Archiv f. klin. Med., lxxxii., Heft 5 und 6.
[3] Archiv. de médecine experimentale, No 1, 1905.
[4] Folia hematologica, ii., 395, 1905

(Peyer's patches, glands, etc.) was seen, together with numerous small hemorrhages into the skin and serous membranes. The marrow of the diaphysis of the long bones was dark red and showed megaloblastic degeneration and the presence of numerous large and small lymphocytes.

Kerchensteiner[1] reports a case in which the hemoglobin and red cells were of the type seen in pernicious anæmia; the leukocyte count was 5300 to 6700 and a swelling of the spleen was present. The lymphocytes were 5.5 per cent. and 10 per cent. at two examinations. Very few normoblasts and megaloblasts were found in the blood. On section the spleen showed a distinct myeloid change, which condition was also found in the bone-marrow. Erythroblasts, normoblasts and megaloblasts were found in the tissues. There were no mast cells and eosinophilic myelocytes were very rare, which speaks against a leukæmic nature of this case. On the other hand the spleen was red, poor in megaloblasts, while many normoblasts and myelocytes were to be seen. On account of these apparent contradictions he places this case among the leukanæmias.

Scott and Telling[2] report the case of an eight-months-old boy without any sign of rickets or syphilis, who presented a severe anæmia, asthenia, and jaundice. The spleen was greatly enlarged and the liver slightly so. There were 1,831,250 erythrocytes among which were 7500 normoblasts and 400 megaloblasts to the cubic millimetre. The leukocytes numbered 18,043 and consisted of 41.8 per cent. neutrophiles, 0.4 per cent. eosinophiles, 2 per cent. neutrophilic myelocytes, 2 per cent. mast cells, 9.8 per cent. large mononuclears, 42.8 per cent. lymphocytes, 1.2 per cent. large lymphocytes. The autopsy revealed a myeloid metaplasia of the spleen and lymph glands; the liver parenchyma resembled the fetal liver. Possibly this was a case of the preleukæmic stage of a myelæmia.

Polycythæmia and Cyanosis. The cases of this condition reported during the past year, with one exception, have been associated with a swelling of the spleen. Pfeiffer demonstrated before the *Physiologischer Verein* at Kiel an unusual case of polycythæmia with cyanosis but no enlargement of the spleen. He called attention to the cerebral congestion, headache and consequent insomnia. Even the eyegrounds were congested. Weber[3] reports a case in which cyanosis was absent, although in all other respects it was a genuine case of this disorder.

It seems to be an accepted fact that the symptom-complex of polycythæmia may arise as the consequence of a tuberculosis of the spleen, or as illustrated by one of Reckzeh's cases, by a slowly growing malignant tumor of the thymus causing pressure upon the superior vena cava,

[1] Muenchener Med. Woch., lii, No. 21

[2] Lancet, June 17, 1905   [3] Ibid., May 13, 1905

the resulting condition of the patient being exactly that of polycythæmia with cyanosis and enlarged spleen. The author was able to produce in animals a similar condition by obstruction and stagnation of the venous flow, and deduces therefrom that the cause of this disease is satisfactorily accounted for by the venous stagnation due to a loss of tonicity in the veins. Also Preiss[1] reports as a case of "Hyperglobulie und Milztumor" a forty-eight-year old man who had had a swelling of the spleen and probably of the liver for six or seven years, and who evidenced the following signs of thrombosis of the inferior vena cava as a result of erysipelas three years before; a diffuse cyanosis, tachycardia, dyspnoea upon mild exertion, mild albuminuria and a considerable distention of the superficial veins over the whole body. The blood showed a great increase of hemoglobin, erythrocytes, and specific gravity. There was also an increase in the eosinophiles and mast cells, some normoblasts and eosinophilic and neutrophilic myelocytes, and at the same time a relative decrease in the lymphocytes. The blood pressure was 120 to 130 (Gartner) and 145 to 150 mm. (Riva-Rocci).

Weber reports a case of *splenomegalic* or *myelopathic polycythæmia* with true plethora and arterial hypertonia without cyanosis. The patient, a Jewish woman, aged thirty-seven years, came to his notice on account of an acute erythromelalgia of the left foot. The polycythæmic condition was discovered later by an examination of the blood. There was no distinct cyanosis of the face though the cutaneous bloodvessels were somewhat overfilled and the tongue though of a bright red color had a slight bluish tinge. The spleen was enlarged to two fingers' breadth below the ribs. Injection of tuberculin gave no reaction.

The subjective symptoms consisted of a fulness and roaring in the head which was rhythmic with the heart's action, occasionally headaches and slight vertigo. The pulse was regular, 80 to 90 beats to the minute and of rather high tension (157 mm.). The hemoglobin varied from 145 to 164, the red corpuscles from 8,400,000 to 10,960,000, the leukocytes from 6000 to 8800. Differential counts showed an increase in the polymorphonuclears (66 per cent. to 81 per cent.). The red cells varied in size and in shape and staining capacity, the average diameter, however, being about normal. A few normoblasts were found.

The viscosity of the blood, the blood volume, and the specific gravity were all increased, the latter being 1078.

The patient at the last report was still living and had shown some slight improvement symptomatically. She seemed to be better when on a diet containing relatively little meat and when taking lemon-juice daily. Small doses of iodide of potassium or salicylates seem to have a favorable influence. Roentgen rays apparently have no effect on the

[1] Mitt. a. d. Grenzgebieten der Med. u. Chir., Bd xiii. Heft 3.

erythrocytes. After repeated sittings there was some slight diminution in the number of white cells and a slight reduction in the size of the spleen. This treatment had to be discontinued on account of an increase in the congestion and feeling of fulness in the head.

Weber agrees with Watson on the pathological activity of the bone-marrow in the production of erythrocytes as being the cause of the blood and circulatory phenomena. He is unable, however, to give the cause for this abnormal activity and so does not explain the enlargement of the spleen and the other phenomena.

Weber and Watson[1] report the case of a strictly temperate man of fifty-eight years who had noticed a blueness of his nose and extremities for six years. Giddiness and occasional syncopal prostration rendered him unfit for work. He was under observation while in an asylum suffering with confusional insanity. He presented the usual signs and died during an increase in the cyanosis. The erythrocytes rose from 10,000,000 to 11,150,000 during the course of the disease, and the white cells fell from 12,000 to 8,000. Blood pressure was from 140 to 170 mm. The hemoglobin varied from 130 to 170 per cent. The differential count of the leukocytes was normal. The authors declare the patient excreted a normal amount of urea. They emphasize the capillary and venous distention during life and postmortem. The marrow of the long bones had assumed a greatly increased hematopoiesis as indicated by the large number of erythroblasts and they say that this is a "vital reaction" to stimulating agents which in ordinary individuals would not have been able to excite any reaction. Engorgement of the pulp with blood was the cause of the enlargement of the spleen. They found that the specific gravity and the viscosity of the blood were greatly increased, in consequence of which osmosis would be very difficult, and to meet the demand of the tissues dilatation of the small vascular channels would have to occur. Inasmuch as the cause is continuously operative, and they have proven to their own satisfaction that the hyperviscidity is due to the great number of cells in the circulating blood, a true plethora would arise, the limited osmosis caused thereby being responsible for dry skin, scanty urine and the like. The following are their conclusions:

1. Increased erythroblastic activity involving a great part but not necessarily the whole of the bone-marrow.

2. Dilatation of small bloodvessels due partly to lessened resistance to the abnormally viscid blood and partly to make room for the dilution of the blood.

3. Increased viscosity of the blood resulting from polycythaemia.

[1] See above; also International Clinics, Series 14, vol. iv., 1905.

4. The "plethora vera" or "polyhaemia" is probably to be regarded as an attempt to compensate for the increased viscosity of the blood and for the excessive percentage of the total blood volume occupied by the cells. In fact it is necessary first, that there should be sufficient blood plasma to nourish the tissues and make metabolism possible; and secondly, that the viscosity may not become so great as to render sufficient circulation impossible.

5. The arterial hypertonia is to be regarded as a result of the greater strain thrown on the circulatory mechanism.

6. Cyanosis, when this occurs, is probably due to an inadequacy of the series of compensatory changes, which according to this view, precede it.

Weintraud[1] states that the specific gravity and the dry substances of the blood as a whole are increased, but the serum is rich in water by reason of poverty of dry matter. In view of the cases without splenic tumor, this observer considers it most probable that there is a decreased or retarded destruction of red blood cells in consequence of a deficiency of some organic function (liver?).

Weintraud adds three new cases of this disease with splenic tumor. Malaria, alcohol, and syphilis seem to play no part in the etiology. The symptoms can be divided into those due to disturbances of the circulation, especially of the brain, and those due to the enlargement of the spleen. His first case occurred in a man in whom there appeared as complications œdema of the legs and phlebitis, and later gout associated with general dropsy to which he succumbed. Years before his first symptoms appeared an excess of uric acid had been found in his blood. The other two patients still live; one of them seems to be benefited by venesection every six months, although the composition of his blood does not seem to be affected. His relief after a severe hemorrhage from the stomach was unmistakable. The third was apparently benefited for a time by a course of Marienbad waters, vegetable diet and restriction of fluid, but serious complications on the part of the heart supervened calling for digitalis and diuretics. The spleen in this case diminished to nearly the normal size. Weintraud says the liver may be enlarged but it remains soft.

Ascoli[2] reports the case of a young man who had suffered mildly from malaria and erysipelas. Beside the classical symptoms there were present digestive disturbances, dyspnœa and a marked pigmentation of the face. The tuberculin test was negative. The erythrocytes amounted to 7,200,000, the leukocytes to 15,000. A differential count of the latter gave the following: polynuclear neutrophiles 51 per cent., eosinophiles 20 per cent., large mononuclear and transitional forms 11

[1] Zeitsch. f klin. Med., lv., No. 91.   [2] Riforma Medica, xx., No. 51.

per cent., mast cells 2 per cent., lymphocytes 16 per cent. The hemoglobin was 95 per cent., and the iron content was equivalent to 0.69 grams to the litre of blood. This is of course considerably in excess of the normal and is in accord with the increased specific gravity as reported by others. Ascoli states that no other case on record shows such a high percentage of eosinophiles. There were also noted dilatation of the stomach and absence of hydrochloric acid, which conditions the author thinks were due to the modification of the circulatory mechanism of the gastric mucosa. The patient was given arsenic for some weeks and left the hospital with a little subjective improvement.

Begg and Bellmore[1] in their observation of a middle-aged woman suffering with this condition, noted 1.5 per cent. of eosinophiles, 5 normoblasts in counting 1200 leukocytes and some polychromatophilia and poikilocytosis.

Practically nothing has been added to the therapeutics of polycythæmia during the past year but Ascoli and Reckzeh emphasize the importance of bearing in mind the possibility of tuberculosis of the spleen in all cases and therefore, splenectomy should always be considered when this condition cannot be excluded. It is sometimes practically impossible to differentiate between a simple splenic tumor and tuberculosis even at exploratory laparotomy, and when operative interference is considered one should not forget the hemorrhagic tendency possessed by these patients. It is likely that most cases dependent upon tuberculosis will be cured by splenectomy. The effect of periodic bloodletting seems to be beneficial but only in a transient manner, *e. g.*, the case cited by Weintraud. This bleeding has no material influence upon the composition of the blood. The effect of drugs is practically nil. Deprivation of iron-containing matters is the advice of all observers. Several patients have been given *x*-ray treatment but the reporters of these cases hesitate to ascribe any value to its application. In one case, however, there was some material improvement in the symptoms. The blood picture was not affected. A case now under my own care (not yet reported) has shown slight improvement while under continued *x*-ray treatment.

Leukæmia. During the past year a great deal has been written on this subject, the greater part being on the treatment of leukæmia by means of the Roentgen ray. However a number of cases of acute leukæmia have been reported and other interesting contributions have been made.

ACUTE LEUKÆMIA. *Etiology.* The etiology of acute leukæmia as well as that of other forms still remains an unsolved problem. Mendelsohn,[2] in discussing a case reported by Sondern and himself, says that

[1] Edinburgh Medical Journal, May, 1905.

[2] New York Medical Journal, December 2, 1905.

to one who sees the course of acute leukæmia the feeling comes that we have here to deal with a virulent infection. In Edsall's[1] case the extraction of a tooth was followed by the evidences of leukæmia and as he suggests, the thought might arise that here was the portal of infection; but it was his idea that a leukæmic infiltration of the gums was the cause of the dental trouble and that the leukæmia antedated the extraction of the tooth.

McCrae[2] reports five cases, and in two of these bacteria were found in the blood, in one case streptococci and in the other streptococci and staphylococci. He thinks that their occurrence was probably incidental, being simply a secondary infection. Rod-like bodies were seen in the blood in one case but no parasites were found.

In the thirteen cases reported, all but two were under twenty-one years of age. McCrae's varied from three to twenty-one. Larrabee[3] reports a case in a six weeks infant, Hand[4] one in a child of two-and-a-half years, MacWeeney and Dennis[5] one at three years, Donnan[6] one at twelve, Blackacker and Gillies[7] one at fifteen, and Stevens[8] one at seventeen. Edsall's case was thirty-six and Mendelsohn and Sondern's forty-two.

Pathology. Sondern describes the pathology of acute lymphatic leukæmia. At autopsy the most striking thing is the large number of hemorrhages. They occur in the mucous membrane, the skin, the pericardium, the peritoneum, the pleura, the retina, the genitourinary tract, the intestine and the brain.

The lymph nodes show more or less enlargement and occasionally extravasations in their substance. The tonsils, lymphatics of the stomach and small and large intestines, and lymphatic structures of gums and tongue are all involved, being swollen, showing extravasations of blood and, occasionally, areas of necrosis. The lesions in the intestine simulate those of typhoid and are no doubt frequently mistaken for them. The spleen is more or less enlarged and soft and shows enlargement of its follicles. The bone-marrow shows great cellular accumulation, particularly in the long bones; the marrow is very dark and hemorrhages are frequent. The kidney, liver, and thymus show marked accumulation of lymphoid cells, with fatty changes in the heart and liver. Parenchymatous nephritis and endocarditis have also been observed. Histologically all the lymphatic structures show a great accumulation of leukocytes of the same variety as those found in the circulating blood and they also present evidence of hemorrhage, ulceration and necro-

[1] American Journal of the Medical Sciences, October, 1905.
[2] British Medical Journal, February 25, 1905.
[3] Boston Medical and Surgical Journal, January 12, 1905.
[4] Archives of Pediatrics, December, 1905.
[5] British Medical Journal, February 25, 1905.   [6] Ibid.
[7] Archives of Pediatrics, December, 1905.   [8] Lancet, January 21, 1905

sis. The bone-marrow shows great cell accumulation, but instead of the usual granular myelocyte, a non-granular large lymphocyte is found.

Blood Picture. The blood usually shows hemoglobin 25 or 35 per cent.; erythrocytes, 1,750,000 to 2, 250,000; leukocytes from normal to 350,000.

Differential counts usually show the large lymphocyte to be the prevailing type of cell and the various percentages are about as follows: Small lymphocytes, 4 per cent.; large, 90 per cent.; polymorphonuclear, 4 per cent.; eosinophile, 0.5 per cent.; myelocytes, 2 per cent; no basophiles or eosinophilic myelocytes. Occasionally nucleated red cells are found but they are not very abundant.

In three of McCrae's five cases the prevailing type of cell was the small lymphocyte. This is unusual. In the case of Mendelsohn and Sondern the large lymphocytes comprised 67 per cent. of all leukocytes until the day of death, when they fell to 30.3 per cent. and the small lymphocyte became the prevailing type, increasing to 53.1 per cent.

In Hand's[1] case the small and large lymphocytes are classed together and comprise 85 per cent., but a remarkable finding is the low number of white corpuscles. There were only 6300, although the differential count gave a characteristic picture of lymphatic leukæmia. He calls it an aleukæmic leukæmia and thinks something kept the increase of white cells in abeyance.

In Larrabee's[2] case, a child of six weeks, there were 918,000 leukocytes of which 99 per cent. were lymphocytes. This is unusual as the number of leukocytes in acute leukæmia is not usually so high, rarely going above 350,000. McCrae thinks that the red cells in acute leukæmia should be studied more carefully and the possible relationship to pernicious anæmia should be considered.

Under the pathology of the disease, it is fitting to speak of Edsall's[3] work on the metabolism of acute leukæmia. He was able to conduct a short metabolism experiment on a patient suffering with a very acute form of leukæmia and found an enormous increase in the excretion of nitrogen and a moderate increase in the excretion of phosphorus. Twenty-two grams of nitrogen were excreted in twenty-four hours and two grams of P_2O_5. This confirms the work of other writers and shows that an enormous destruction of tissue takes place within the body in acute leukæmia. Magnus-Levy attributes the increase in nitrogen to the hemorrhages which take place but Edsall interprets it differently. He thinks it is due to a disturbance in autolysis and sees in it the response of the organism to the disease.

Symptomatology. Mendelsohn and Sondern and Edsall call particular attention to the condition of the throat. In the case reported by the first authors, the case resembled diphtheria so strongly that anti-

[1] Loc. cit.   [2] Loc. cit.   [3] Loc. cit.

toxin was given. In Edsall's case he speaks of the strong similarity to diphtheria, and says a diagnosis of diphtheria could not be excluded without culturing the throat. There was pseudomembrane on both tonsils and the laryngeal and nasal conditions characteristic of diphtheria. The tissues of the neck were greatly swollen and infiltrated so that at first glance the case looked like one of angina Ludovici. There was a little later in this case evidence of marked constriction in the larynx, so marked that a tracheotomy was considered. Infiltration of the larynx, comparatively common in chronic leukæmia, has apparently never been observed before in acute leukæmia.

There was also a marked hemorrhagic tendency in this patient, so marked that at the first blood examination, about a pint of blood was lost through the small puncture made for this purpose.

In Stevens' case there was no enlargement of the spleen or lymph glands until the thirteenth day of the disease, and after the diagnosis of leukæmia had been made. There was in this case very marked and constant priapism from the beginning of the case, which was exceedingly painful and which lasted until death.

Diagnosis. Acute leukæmia must be distinguished from typhoid fever, malignant endocarditis, miliary tuberculosis, septicæmia, and in some instances from diphtheria. All observers emphasize the importance of a blood count. Indeed without this a diagnosis is almost impossible. Not alone should the white count be made, but also a differential in all cases showing any suspicious symptoms, for although the leukocyte count is usually sufficient for a diagnosis, there are cases in which the white blood cells are normal in number and the characteristic features of leukæmia are only brought out by a differential count.

Treatment. Nothing has been added to the treatment of acute leukæmia and until the disease is more thoroughly understood, little can be done to help the patient.

MYELOID LEUKÆMIA. *Etiology.* Arnsperger[1] writes of eleven cases of myeloid leukæmia all of which occurred within a few years in a small district of six villages along the Enz River. One of the cases was observed at Pforzheim, a little farther down the river. One village had three, two had two, and the others one each. No family antecedents could be discovered, except in one case in which a younger sister had died of leukæmia. The subjects were five women, four men, and two children. Some of the men were farmers, others factory hands. Direct contact could not be demonstrated in any case. The district has had several epidemics of typhoid, but the sanitary conditions have been improved of late years. Spring water is used in the villages but not the same spring by any of the families affected. A history of typhoid was established in three

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[1] Münchener medizinische Wochenschrift, lii., No. 1.

cases and in one the enlargement of the spleen had not subsided. Five of the cases were very carefully observed. The others were known only from communications of the attending physicians.

Blood Picture. Nauwerck and Moritz[1] report a case of myeloid leukæmia complicated by osteosclerosis. Clinically the case was not characteristic of leukæmia and the authors were chary about making a diagnosis and only at autopsy was the diagnosis cleared up. The spleen was greatly enlarged, reaching nearly to the crest of the ilium and to the right of the median line. The liver was also enlarged to the level of the umbilicus.

The first blood count showed hemoglobin 60 per cent., erythrocytes 3,700,000, leukocytes 7000. A differential count showed polymorpho-nuclear neutrophiles, 65.94 per cent.; neutrophilic myelocytes, 4.68 per cent.; eosinophilic polymorphonuclears, 7.09 per cent.; small and moderate sized lymphocytes, 16.2 per cent.; large mononuclears and transitional, 5.94 per cent. Eosinophilic myelocytes were present. There were also poikilocytes, microcytes, and irregular poorly stained frag-ments of erythrocytes. There were nucleated red cells, mostly normo-blasts, but only one megaloblast.

The subjective symptoms were greatly improved although the blood picture remained about the same, but the patient complained bitterly about the enlarged spleen and it was decided to remove it.

This was done and the blood picture immediately changed. Four days after operation the blood count showed: erythrocytes, 3,700,000; leukocytes, 6,900. The differential count was as follows: polymor-phonuclear neutrophiles, 86.96 per cent.; neutrophilic myelocytes, 0.89 per cent.; polymorphonuclear eosinophiles, 0.0 per cent.; myelocytic eosinophiles, 0.0 per cent.; small and moderate lymphocytes, 8.53 per cent.; large mononuclear and transitional cells, 3.56 per cent.

There were poikilocytes, macrocytes, and microcytes present. Nu-cleated red cells were in enormous numbers, for the most part normo-blasts, some megaloblasts. In a single red cell were found two to three nuclei of very unequal size. Single nuclei of dumb-bell and rosette form were also noted. A well-defined mitosis was found in a megaloblast. The patient shortly afterward developed a pneumonia and an empyema and died. The blood count made at this time differed from one just given in no essentials except for a decrease in nucleated reds to the number found before the splenectomy. At autopsy an osteosclerosis was found involving the whole osseous system and this the authors think was responsible to a certain degree in explaining the blood picture, by narrowing the space and hampering the functional activity of the mar-row. They think that the spleen had taken up the development of part

[1] Deutsche Archiv fur klinische Medizin, lxxxiv., Nos. 5 und 6.

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of the blood elements, notably the red blood corpuscles and that the extirpation of the spleen suddenly called forth a number of erythrocytes and the bone-marrow could only furnish poorly developed ones. The gradual return to normal seems to speak for a gradual increase of red cell formation in the bone-marrow.

Browning[1] describes a case of *mixed cell leukæmia* and draws the following conclusions:

1. Myeloid leukæmia is due to a hyperplasia of myeloid tissue, but the unknown causative agent is irregular in its action, so that any of the various granular types may predominate or a mixed cell blood-picture may result from the reversion of many of the cells to the condition of the non-granular or undifferentiated leukoblast or from the hyperplasia of such non-granular cells normally present in the marrow in small numbers. These undifferentiated leukoblasts may assume their embryonic activity and secrete granules.

2. In leukæmia a mixed cell blood picture may be due to (*a*) a reversion of myeloid cells to the embryonic non-granular type and (*b*) a reactive or mechanical disturbance of myeloid tissue owing to lymphoid hyperplasia with, as a result, the passage of myelocytes into the circulation.

3. It is to be understood that it is left quite an open question as to whether or not myeloid and lymphoid tissue may be concomitantly affected in a way similar to that which occurs in myeloid and lymphatic leukæmia respectively. If such occurred then we would have a mixed cell leukæmia in the strict sense.

Hirschfeld[2] discusses a typical blood picture in leukæmia and reports a case in which the blood findings were absolutely typical, but after a pneumonia and treatment by means of the Roentgen ray, there was a disappearance of mast cells and a great diminution in eosinophiles although the other factors remained constant. This he considers a case of atypical leukæmia.

Helly[3] replies to Hirschfeld's article and thinks he does wrong to call his case atypical, for complications undoubtedly modify the blood picture. He thinks that a normal number of white blood cells does not exclude leukæmia if the characteristic blood-picture is present.

Effect of the X-ray on Leukæmia. During the past year, a good deal of work, both experimental and clinical, has been done on the influence of the Roentgen rays in leukæmia.

Linser and Helber[4] have performed some very interesting experi-

[1] Lancet, August 19, 1905.
[2] Berlin. Klinische Wochenschrift, xlii., No. 31, July 31, 1905.
[3] Ibid., xlii., No. 38.
[4] Deutsche Archiv für klinische Medizin, lxxxiii., Nos. 5 and 6.

ments on the effect of the *x*-ray in normal animals. They found that by continued application of the *x*-ray they were able to decrease the erythrocytes, leukocytes and hemoglobin, but principally the leukocytes, and of these the lymphocytes suffered to the greatest extent. There were no collections of leukocytes in the viscera to explain their disappearance from the circulating blood nor was there any difference in the blood from the peripheral circulation and that from the heart. In rats which were killed after *x*-ray treatment of five to eight hours, they found in the spleen a considerable number of lymphocytes. They found these in the follicles of the spleen, also in the bone-marrow and in the intestine. They found nuclear debris very infrequently and then only in the liver.

In rabbits, in the circulating blood of which a great reduction in white cells was made, the spleen, bone-marrow and intestinal follicles were very poor in leukocytes, yet the impoverished condition was greater in the animals which died after treatment. Lymphocytes were almost entirely absent. The bone-marrow showed a lessened number of cells and no lymphocytes. The development of the erythrocytes did not seem to be injured. In dogs they did not find so marked a change as in rabbits and rats and it was harder to produce in dogs a reduced number of leukocytes. If the *x*-ray treatment was stopped the blood resumed its normal condition. This seems to annihilate the theory that the blood making organs are destroyed. The authors believe contrary to Heineke, that the destruction in the circulating blood is primary, and in support of this say:

1. That the leukocytes are found in the follicles of the spleen, follicles of the intestine and in the bone-marrow when absent from the circulating blood.

2. They will take up stain in the organs when they will not in the blood, showing that the cells in the circulating blood are more degenerate.

3. A direct damage to the hæmatopoietic organs is improbable in the face of the established capacity for regeneration.

4. It is a matter of indifference what part of the body is treated by the *x*-ray.

The cells obtained from an aseptic empyema in an animal treated by the *x*-ray showed vacuolization and poorly staining nuclei. The serum also contains a leukotoxin.

The authors conducted a series of experiments with the serum obtained from animals treated by Roentgen rays and they found:

1. That the serum of a treated animal when injected into a normal animal caused a destruction of leukocytes, shown by a decrease in their number. The decrease in the number of leukocytes was marked, came on about two hours after the injection and there was a return to the

normal in twenty-four hours. The decrease in the leukocytes varied with the time the animal had been treated by the ray.

2. They found in animals injected with normal serum that there was an increase in the number of leukocytes, this increase coming on in about two hours with a return to the normal in twenty-four hours.

3. They subjected the fluid from an aseptic empyema to the influence of the x-ray outside the body and found that this serum had the same effect on the blood of normal animals as the serum that came from the animals treated by the x-ray.

4. They separated the leukocytes from the blood of a normal animal and then treated the serum with the x-ray and injected this serum into normal animals. It was followed by the same phenomena that attended the injection of perfectly normal serum, namely, an increase in the leukocytes, coming on in two hours with a return to normal in twenty-four hours.

5. They tried the effect of heat and cold on the serum and found that there was no destruction of the leukocytes after the serum had been subjected to 60° C. for one-half hour or to a freezing temperature for seventy-two hours.

6. They found that when an animal was treated by the Roentgen ray that the leukocyte count formed a characteristic curve, first a fall and then a gradual rise.

7. All their animals treated by the Roentgen ray died and it was found that they all had a more or less high grade of nephritis. They treated animals with the x-rays and examined the urine finding that albumin and casts came on after an exposure of several hours but slowly disappeared if the treatment was stopped. It was proved that it was not from the direct effect of the x-ray, by protecting the kidneys with leaden plates while the animals were being treated.

In those treated by the serum a milder grade of nephritis was found. The conclusions are as follows:

1. The white blood cells are affected in an elective manner by the Roentgen ray, the lymphocytes being most susceptible to its influence.

2. By the action of the ray there arises in the circulating blood and also in blood treated outside of the body, a leukotoxin which when the serum is injected into animals causes a destruction of leukocytes.

3. This leukotoxin produces an immunity against itself.

4. The leukotoxin produces nephritis by its elimination by the kidneys.

5. On erythrocytes, the blood platelets and hemoglobin, the x-ray has little or no effect. The coagulability does not suffer.

Curschmann and Gaupp[1] by a series of interesting experiments fill

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[1] Muenchener Med. Wochenschrift, No. 50, 1905.

in the breach between the original researches of Heineke who showed that a peculiar change took place in the blood forming organs under the influence of the Roentgen ray, the report of Senn, who first treated a leukæmic patient with the *x*-ray, and the work of Linser and Helber just detailed.

Up to their present work, no one has attempted to measure the leuko-toxic effect of the blood of a leukæmic patient exposed to *x*-rays, upon the blood of experimental animals.

The following was the procedure:

G. G. aged forty-eight years. Sick for three and one-half months complaining of general weakness, dyspnœa and pallor. For four weeks had noticed a growing tumor in the left upper abdominal region, the skin was a dirty yellow and there was marked ozena. The occipital, interaural, cervical, axillary, and thoracic glands were swollen to the size of a bean or a pea, apparently hard and indolent. No change was noted in the skin or mucous membranes; no hemorrhages. The heart and lungs were normal. The liver was somewhat enlarged and indurated. The spleen was greatly enlarged, overlapping the costal margin for 9 cm. and was very hard and tender.

The urine contained no albumin; Bence Jones' albumin bodies were absent; and there was no sugar; the biuret reaction was negative.

The hemoglobin was 50 per cent.; the leukocytes numbered 150,000, and the erythrocytes, 2,080,000. The differential count showed lympho-cytes, 94 per cent.; mononuclear basophiles, 22.75 per cent.; polymorpho-nuclear, 22.75 per cent.; eosinophiles, 0.5 per cent.

The patient was treated by the *x*-ray for a period of a little over a month from the twenty-second of one month to the twenty-sixth of the next. The effect of the treatment is shown in the following chart:

Date.	Time of Exposure.	Leukocytes.	Lymphocytes.	Polymorpho-nuclears.	Mononu-clears.	Eosinophiles.
22	60 minutes	150,000	94 per cent.	2¾ per cent.	2¾ per cent.	0.5 per cent.
6	15 "	92,000				
8	15 "	112,000				
14	10 "	72,000				
18	10 "	44,000				
26	10 "	114,000	85 per cent.	12 per cent.	1.9 per cent.	1.9 per cent.

Treatment was shortly afterward discontinued on account of the appearance of albumin and casts in the urine and of a local dermatitis.

Blood was withdrawn from this patient, defibrinated and centrifu-gated, and the serum injected into animals. In two animals into which serum was injected before the patient had been treated by the *x*-ray, there appeared a slight decrease in the leukocytes in five to six hours, from 19,000 to 16,000 in the one case and from 16,000 to 13,000 in the second. Then the serum was injected into animals after the patient had been under treatment for sixteen days and a primary leukopænia was noted coming on in ten to thirty minutes, followed by a reactive hyper-

leukocytosis in one to two hours, this was succeeded in turn by a hypoleukocytosis coming on in four to six hours, being earlier when serum was injected intravenously, later when injected subcutaneously. As an example, in one experiment the blood showed 39,000 leukocytes before injection. Ten minutes after injection it showed 16,000, increasing to 41,000 in an hour and at the sixth hour being 13,000. After heating the serum at 60° C. for one-half hour, they found a slight leukopenia in thirty minutes but no succeeding hypoleukocytosis; indeed, there seemed to be an increase. With normal serum there was also an initial leukopenia followed, however, by no hypoleukocytosis.

They also mixed normal human blood in a Zeiss pipette with this serum and isotonic NaCl solution; another pipette contained normal blood, salt solution and inactivated serum; a third normal blood and salt solution; and the fourth simply staining solution and blood. After incubating the four pipettes for two and one-half hours, in pipette No. 1 the cells had diminished from 330 per c.cm. to 210; in No. 2 from 400 to 360; and in the other two there was no change. In twenty hours No. 1 had diminished from 330 to none, the leukocytes being totally destroyed. In No. 2 they had diminished from 400 to 250, and in Nos. 3 and 4 no change had taken place.

The authors conclude: 1. Through the action of the Roentgen ray on the blood of leukæmic patients there appears in the blood a specific leukotoxin that exerts an elective destructive power on the leukocytes of the circulating blood of experimental animals and normal persons.

2. It is inactivated by half hour's warming at 60°C. and completely loses its faculty of destroying leukocytes in the circulating blood.

3. The injection of leukæmic blood in normal animals causes an immediately appearing leukopenia of one to one and one-half hours duration followed by a reactive hyperleukocytosis and five to six hours later by a hypoleukocytosis.

Some very interesting work has been done in determining the influence of the *x*-ray on *metabolism* in cases of leukæmia. J. Lossen and P. Morawitz[1] detail the chemical and histological findings in two cases of myeloid leukæmia treated by the Roentgen ray.

The first case was a typical case of myeloid leukæmia and from November 8th to November 24th had daily treatments of ten minutes each over the spleen, and from November 24th to December 10th every third day for fifteen minutes. On December 6th an erythema was noticed over the region of the spleen and the treatment was continued over the tibia every three days for fifteen minutes. The treatment was stopped February 2d as the patient was entirely well and the blood findings were

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[1] Deutsche Archiv klinische Medizin, lxxxii., Heft 3 und 4.

such that further treatment was considered unnecessary. The spleen had shrunken from 24 x 12 cm. to a condition in which it was just palpable and measured 12 cm. in length. The liver had decreased from three fingers' breadth below the costal margin to two fingers breadth below. The patient gained twenty-six pounds, felt entirely well and was at work. The whole duration of x-ray treatment was six hundred minutes.

The experiment in metabolism was started a week before the x-ray treatment, and the excretion of nitrogen, uric acid, and P_2O_5 determined. In the first period of x-ray treatment from November 9th to November 24th, the excretion of all three was decreased although the nitrogen-uric acid quotient remained stationary. In the second period from December 8th to December 15th, there was an increase in the amount of nitrogen and P_2O_5. In the case of the nitrogen the increase was decided and returned almost to the amont excreted before the ray treatment was instituted. The P_2O_5 showed a very decided increase, the amount excreted being 0.50 gramme more than during the preliminary period of November 1st to 8th. The uric acid increased very slightly and was decidedly lower than in the preliminary period. In the period from December 8th to 15th, the nitrogen-uric acid quotient was 20 to 1 while in the preliminary period it was 14 to 1. This change was due to a decrease in the amount of uric acid excreted as the nitrogen remained practically the same.

This result is in consonance with what the authors expected and argues a decreased manufacture of leukocytes, due to the influence of the x-ray on the blood making organs.

In their second case, there was no improvement in symptoms after the x-ray treatment and the patient grew worse and died. There was a metabolism experiment and here it was found that there was an increase in the excretion of nitrogen and uric acid immediately after the treatment was started which did not happen in Case I.

This preliminary increase was found by other observers, von Joachin, and Kemp and Krause. Afterward there was a decrease; but after the x-ray treatment was stopped there was an increase in uric acid excretion coincident with a decided fall in the leukocyte count. There was a decrease in the size of the spleen during the treatment but no change in the blood condition until the treatment was stopped when the leukocyte count fell very rapidly; the proportion of different forms remaining, however, the same. The leukocyte count fell very rapidly and the day before death showed only 750 per c. mm. At autopsy there was found an aplastic condition of the bone-marrow, spleen and lymph glands and a marked increase in fibrous tissue.

The authors conclude:

1. In a case of myeloid leukaemia in which the leukocyte count fell

from high to normal, the uric acid excretion fell from high to normal and the nitrogen-uric acid quotient changed from 14 to 1 to 20 to 1. This was probably due to a lessened development of leukocytes.

2. The uric acid excretion can remain high in extreme leukopenia in a leukæmic who has been treated by *x*-rays.

3. Under the influence of the rays, there can be brought about a nearly normal condition of the blood. Also we can arrive at an aplastic condition of the blood forming organs.

4. It is possible that this *x*-ray can give rise to an aplastic or hypoplastic condition of the blood forming organs.

Musser and Edsall[1] treated two cases of myeloid leukæmia with the *x*-ray and carried out metabolism experiments coincidently. In Case I. in which *x*-ray treatment had been tried on a previous occasion with good results, the second course of treatment failed to benefit and the patient died. The metabolism experiments showed no increase in the excretion of nitrogen, uric acid or phosphates and indeed there was a retention of phosphates.

In Case II. the patient was markedly benefited and showed a decrease in white cells from 245,000 to 9040 although there still remained a few myelocytes. The spleen decreased from a position an inch above Poupart's ligament, and anteriorly to the median line to a condition where it was barely palpable. There was a coincident amelioration of all symptoms.

In this case there was a marked increase in the elimination of nitrogen (70 per cent.), of uric acid (60 per cent.), of phosphates (200 per cent.), and of purin bases (260 per cent.). In this case also there was phosphorus retention but the authors consider that due to the slowness with which the phosphates are eliminated.

In the discussion of these cases Musser and Edsall contrast the *toxæmia of leukæmia* with tissue retention, with the toxæmia of other nutritional disorders having marked tissue loss, such as diabetes, Addison's disease and exophthalmic goitre. They think most of the amount retained was used for building leukæmic tissue.

Another point is the fact that there is no toxæmia developed when tissue loss takes place under the influence of the ray. On the other hand, there was marked improvement in the one case on the advent of tissue loss and in the other when there was no loss and no increase of tissue destruction the patient grew markedly worse. The symptoms of marked toxæmia in leukæmia, which do occur, the authors think are caused either by products elaborated by leukæmic tissue in the ordinary course of metabolism, these products being more toxic than the products of metabolism of normal tissue; or the toxæmia may arise from substances

[1] Univ. of Penna. Med. Bull., September, 1905.

elaborated in the course of the synthetic processes that go on during the actual building up of the leukæmic tissue. They think the former theory the more probable but cannot dismiss wholly the latter. They think the x-ray exerts its influence not by a direct influence on the leukæmic tissue, the blood making organs or on the blood, but by a stimulation of the autolytic powers of the organism. They think great care should be exercised in the application of the x-ray and especially in individuals suffering from kidney trouble.

Results of Treatment by Roentgen Ray. A great many cases have been reported during the past year in which the x-rays were applied and the results have been generally good. No instances of absolute cure have been reported and in most of the cases there was symptomatic cure coincidently with a reduction of the leukocytes to normal or almost normal and a disappearance of the abnormal forms from the blood picture in a marked degree.

In some of the cases this condition lasted while the patient was under observation and in others there was a gradual increase in the number of leukocytes and a return of aberrant forms in the blood.

F. Lommel[1] reports a case of myeloid leukæmia in which the patient considered himself cured and the blood findings approached the normal. Six months later there was an increase in the white cells although the general health remained good.

K. H. Schirmer[2] reviews the articles published on the subject and says that of seventy-two cases published, in nearly every instance there was marked benefit from the x-ray. The spleen decreased in size and the leukocyte count fell to normal or markedly improved. In some cases there was a transient disappearance of myelocytes.

De La Camp[3] says that in 90 per cent. of cases there is improvement but the term cure had better not be used. He reports twenty-five cases of myeloid leukæmia improved and four in which there was no change. He speaks of the work of Wendel[4] who reports thirty-eight cases and of these 90 per cent. were improved. He also speaks of a case reported by Schutze that had been well for four years. Camp thinks the different conclusions arrived at by different men are usually due to the differences in technique.

Holding and Warren[5] report twenty-five cases of myeloid leukæmia from the literature in which fifteen were improved and in two there was no improvement or the cases terminated fatally. Second, they

[1] Munchener Med. Woch., May 9, 1905, lii. No. 19.
[2] Centralblatt f. die Grenzgebeit, Jena, xliv. p. 747.
[3] Therapie der Gegenwart, March, 1905.
[4] Munchener Med. Woch., January 24, 1905, liii., No. 4.
[5] New York Medical Journal, November 11, 1905.

report eight cases of lymphatic leukæmia in three of which there was improvement and five terminated fatally or showed no improvement.

Capp and Smith[1] report three cases of *lymphatic leukæmia* treated by the *x*-rays, two of which were of the acute form. In neither of these was there any influence to be noted. In two subacute cases the *x*-ray exerted a beneficial effect but did not control them. They report also three cases of chronic leukæmia in which the results were much more favorable. They urged the treatment of chronic myeloid leukæmia with the *x*-ray and though the response to treatment is slower than in the chronic lymphatic variety it seems more permanent. They can hardly be called cured in the light of the cases in which the blood count has come to normal and the symptoms disappeared and in which there was later recurrence and death. It is probable that the disease is only held in abeyance.

Schenk[2] reports a care of severe lymphatic leukæmia which was only symptomically benefited. The spleen diminished in size and the leukocytes in numbers but the progress of the disease was not stayed.

Cohen[3] reports a case in which the blood findings came down to normal and the spleen was markedly reduced in size and the case was symptomatically cured.

Joachim and Kurpjuweit[4] report two cases, one of myeloid leukæmia and one of lymphatic leukæmia which were treated with the Roentgen ray and both did well. The leukæmic features of the blood disappeared, the large spleen and the enlarged lymph glands all returned to normal. The general health was markedly improved also.

Ledingham and McKewon[5] report the case of a boy of eleven who had typical myeloid leukæmia. He was confined to his chair, unable to walk without great dyspnœa and discomfort. His leukocytes were 234,000. The treatment was initiated and the boy was markedly improved. The leukocytes dropped to 23,000, on one occasion to 17,400, but the myelocytes did not disappear from the blood. His spleen which had extended to the crest of the ilium was greatly diminished in size. His general health was greatly improved and he was able to walk about and even to climb stairs without discomfort.

Schleip and Hildebrand[6] report a case of myelogenous leukæmia treated by the *x*-ray. The spleen was greatly enlarged and leukocytes were increased to 320,000. In this case the treatment was used for

[1] Chicago Med. Soc., January 25, 1905.
[2] Münch. Med. Woch., li. No. 48.   [3] Ibid.
[4] Deutsche Med. Woch., Berlin, Leipsic, xxx. No. 49.
[5] Lancet, January 14, 1905.
[6] Münch. Med. Woch., February 28, 1905.

five hundred minutes altogether before there was any improvement, but after this, the spleen decreased markedly in size and the leukocytes fell to 28,000 and the number of myelocytes decreased just about one-half. In this case, arsenic was used in conjunction with the x-ray.

Meyer and Eisenreich[1] report two cases that were both very favorably influenced by the x-rays. They were both typical myeloid leukæmia and in both cases the blood findings returned practically to normal so that it would have been impossible to diagnose leukæmia from the blood. The leukocytes fell in the first case from 165,000 to 6100 but there was a return to 22,000 and later to 35,000. The spleen decreased markedly in the first case but not so much in the second which was of longer duration. The general health was very good in both cases and they were working every day. There seemed to be a tendency to gradual increase of the number of leukocytes after treatment so they hesitate to speak of a cure.

Wendel[2] has collected thirty-eight cases. In 90 per cent. there was improvement. In two instances there was no appreciable change. In two, the disease progressed rapidly notwithstanding treatment. In one instance the patient succumbed to an intercurrent pneumonia. In two others, death ensued although improved at first. The myeloid variety seems to offer a better prognosis than the lymphatic although cases of the latter have been benefited.

Schieffer[3] has treated five cases. Results were fair in three cases and he pronounces them cured for the time at least. One patient abandoned treatment after material improvement by a few exposures. The fifth patient, a man of forty-six years, almost moribund showed marked improvement at first and later the symptoms returned and the patient died in collapse. Schieffer ranks the x-ray in leukæmia with digitalis in heart disease. It produces unmistakably good effect and if even only symptomatic, we cannot afford to do without it.

C. H. Milland[4] reports four cases treated by the x-ray and the results were favorable in all. One was markedly benefited and there was a marked diminution in the size of the spleen and the leukocytes fell from 246,000 to 19,400 and myelocytes were greatly reduced in number. The second case although it improved had a superimposed tuberculous infection to which it succumbed. The other two cases showed improvement of the general health and a decrease in the number of leukocytes and also in the percentage of myelocytes although the blood findings did not come to normal.

J. Smith's[5] experience and study of leukæmia have convinced him

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[1] Münch. med. Woch., lii., No. 4, January 24, 1905.
[2] Ibid.,   [3] Ibid.
[4] British Medical Journal, July 1, 1905.
[5] Berliner klin. Wochenschrift, xlii. No. 48.

that the treatment reduces the consumption of neutrophiles, eosinophiles and mast cells in the circulating blood. The extent of the reduction depends on the duration and intensity of the exposure which may lead finally to far reaching, although never quite complete, restoration of the blood to normal.

The morphological behavior of the blood cells shows, he thinks, that there can be no question of destruction of the circulatory leukocytes or injury of the blood forming organs under the influence of the x-rays. Roentgen exposures have an entirely different action on the sound and on the leukæmic human organisms as he explains in detail. He defines leukæmia as the expression of an immense destruction of leukocytes and constant consequent demand for the production of more, with some special stimulus for the hyperplastic development of the blood forming organs. This stimulus may be some special property of a still hypothetical virus affecting these organs.

W. F. Chung[1] reports the autopsy of a case of myeloid leukæmia previously reported. At the time of the previous report the patient had 60,000 leukocytes. Some time later he began to run down and became discouraged, discontinued the treatment and died. The autopsy showed the damages of a leukæmia.

Brown and Jack[2] report a case which was treated with x-rays and which did very well for some time but ultimately died. The patient was under observation for sixteen months and was in very good condition until about two months before death. His spleen diminished markedly in size and his leukocytes fell from 800,000 to 8,000 and remained in the neighborhood of 8000 for three months and at the same time the myelocytes disappeared from the blood. The leukocytes increased, however, the myelocytes returned and the patient became apparently profoundly toxic and died. There was a normal red blood count and hemoglobin content during the favorable period but these sank as the patient retrograded. The leukocyte count never rose to a point above 78,000 after the ray treatment and the day before death was only 5601.

The autopsy showed only one lesion suggestive of leukæmia and that was the condition of the lymph glands which were hyperplastic resembling those seen in cases of lymphosarcoma or that of lymphatic leukæmia, minus the increase of mononuclear elements in the blood. The spleen was of the same type as that seen in splenic anæmia being characterized by a hyperplasia of fibrous tissue. Counts made of the leukocytes in the vessels show an unusually high percentage of mononuclears. There was, however, nowhere any increase of leukocytes in the vessels suggesting the existence of leukæmia. The calcification existing in the

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[1] California Academy of Medicine, April 25, 1905.
[2] Journal of the American Medical Association, March 25, 1905.

kidney was remarkable for its extent. It suggested the occurrence of an intoxication causing degeneration or necrosis of the epithelium of the convoluted tubules followed by a deposit of lime salts such as occurs in poisoning with mercuric chloride.

Heineke, according to these authors, found that a brief exposure of mice, rabbits and dogs to the rays induces a destructive process in the lymph follicles. With an exposure too brief to induce changes in the skin he could cause a distinct destruction of the nuclei of the leukocytes in the follicles of the spleen leading to their almost complete disappearance. Analogous processes took place in the other lymphoid elements. His remarks on the changes in the bone-marrow are not clear except that some destruction of lymphoid elements took place.

Edsall and Musser[1] report two cases treated by the *x*-rays. One of these cases had had a previous treatment by the *x*-ray and its second application proved without avail and the patient died. The second case did very well, the leukocyte count fell to a marked degree from 304,400 to 9040 and the size of the spleen diminished from a position an inch above Poupart's ligament to above the level of the umbilicus, and coincidently with the changes in spleen and blood there was a marked improvement in the general health of the patient.

The technique of the application of the *x*-ray in leukæmia varies somewhat with different observers but in general is the same. First and foremost the hard rays are used in order to obtain the penetration of tissue necessary and to avoid setting up a dermatitis.

2. The tube is usually placed at a distance of from four to twelve inches from the surface of the body. Using the hard rays at the longer distance seems best for in this way we can avoid the effect of the soft rays, namely the production of a dermatitis.

3. The treatments may be every day, on alternate days, or may be only twice a week, the number of treatments and their frequency depends a good deal on the manner in which the individual reacts to the treatment.

4. The time of the treatment varies from ten to thirty minutes and may be divided up, the ray being applied for fifteen minutes to the spleen and fifteen minutes to the epiphyses of the long bones or the sternum.

5. The rays may be applied to the spleen, to the epiphyses of the long bones, to the sternum, to the vertebra, or to the liver. It seems to be most commonly applied over the spleen and the epiphyses of the tibia or femur.

6. The total length of the treatment may be anything, depending on the progress of the case, but in the large majority of cases it is about six hundred minutes.

[1] University of Pennsylvania Medical Bulletin, September, 1905.

Lindner[1] reports a case of splenic leukæmia treated by *removal of the spleen*. The patient's health was markedly improved although the entire syndrome of leukæmia did not disappear. Four cases are on record that were restored to health by splenectomy. On the other hand, reports have been published of twenty-eight cases in which no benefit resulted from the operation.

In conclusion it can be said that the application of the *x*-rays is the best therapeutic measure we at present possess for the treatment of leukæmia and although we may not be able to speak of cure, yet the patients can undoubtedly be greatly benefited.

Leukocytosis. Brown[2] believes, after reviewing the literature concerning the variations of white blood cells in health and disease that a thorough appreciation of the exact significance of leukocytosis will not be possible until we have definitely determined the mode of origin of the various forms of white blood cells, and their relationship to each other. A study of these cells, however, in the various diseases in pathological conditions has demonstrated beyond a doubt that their determination is of real practical help in the diagnosis and prognosis of disease. There are only a few diseases in which an absolute diagnosis can be made from the blood examination alone, but in many other diseases the condition of the leukocytes aids in making the diagnosis; thus, the study of the leukocytes has rendered possible the diagnosis of a certain number of diseases, as the leukæmias and trichinosis, besides rendering marked assistance in the diagnosis of others, as tuberculosis, typhoid fever, pneumonia, and various inflammatory and suppurative conditions. It tells much in regard to the prognosis of all forms of infection and inflammation and aids in discriminating diseases presenting clinical pictures markedly alike, such as central pneumonia, typhoid fever, appendicitis and conditions simulating it but of entirely different origin, peritonitis and gastrointestinal autointoxication, lymphatic leukæmia and Hodgkin's disease, myelogenous leukæmia and Banti's disease, measles and scarlet fever. It has provided the surgeon and gynecologist with the ready means of determining whether or not he is dealing with inflammatory or suppurative processes, whether the process is diminishing or increasing, and tells him much regarding the prognosis of cases. Leukocyte counting, Brown believes, has not and never will reach the point at which it, and it alone, will furnish us with an absolutely correct diagnosis and prognosis, but in the past it has been a great help, and it will be in the future even more important to the physician and surgeon who value correctly its possibilities and its limitations.

Becker[3] suggests the production of a leukocytosis as a therapeutic

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[1] Deutsch. Archiv f. klin. Med., lxxxv. Heft 2.
[2] American Medicine, Nov. 4, 1905. [3] Therapeutic Gazette, Oct. 15, 1905.

measure. Laboratory experiments have shown that in the acute infections, the toxin is combatted by an antitoxin set free by a destruction of the polymorphonuclear leukocytes. This being true, he believes that the larger the number of leukocytes, the greater the amount of antitoxin set free. In consequence of which there will be a greater power on the part of the individual to combat infection. Clinically he has found that the cases showing a low leukocytic count have a bad prognosis. Becker proposes the production of a leukocytosis by means of drugs. He recommends pilocarpin, sodium cinnamate, and nucleinic acid. He advises the use of the last named remedy in a 5 per cent. solution, 5 to 20 minims being given at a dose. It must be given hypodermically as it is decomposed by the gastric juice. One dose is usually sufficient and improvement begins in six to twelve hours.

The Leukocytes in Disease. Heiman[1] made leukocyte counts in nineteen cases of *bronchopneumonia* occurring in children from ten months to five and one-half years. During the height of the illness, the highest leukocyte count was 73,000, the lowest 12,600 There were twelve recoveries and seven deaths. In the former, all the counts during the first few days of the illness were high, while toward the end of the disease, the counts became low except in two cases, one being complicated by a mastoiditis and the other by tonsillitis. All the seven fatal cases gave high counts early in the disease, but shortly before death in four of the cases, the leukocytes were markedly diminished, while in the other three they remained high. He also studied twenty-four cases of *lobar pneumonia* occurring in children varying in age from two and one-half to nine years. The highest count, while the pneumonia was active, was 55,800. The lowest, excluding a post-typhoid case and a case of pleurisy, was 20,200. There were only two fatal cases and in both of these a well marked leukocytosis was present during the height of the disease, while just before death a marked drop in the count occurred. In seven cases of *empyema* studied, there was a marked leukocytosis at the onset. Six of these recovered and one died. The fatal case gave the highest blood count at the onset of the disease as well as the highest terminal count. The leukocytosis of bronchopneumonia was found to be independent of the amount of lung involved nor did the degree of leukocytosis have any relation to the height of the temperature. Heiman concludes from his observations that though there are some exceptions, the general rule in bronchopneumonia is that failure of the leukocytic count to drop when the pulmonary signs disappear indicates either a complication or a fatal termination of the illness, and that a constant and considerable leukocytosis may regularly be expected in lobar pneumonia of children; the degree of leukocytosis being about the same as in bronchopneumonia,

[1] Archives of Pediatrics, October, 1905.

but differing in that the white count is high when the pulmonary involvement is greater, an increasing leukocytosis being the general rule in children, the maximum being reached just before the crisis. The failure to drop after the crisis may indicate a complication, yet this may be of no special significance. In general Heiman believes that the diagnostic value of the leukocytes in the pulmonary affection of children is limited, but that in certain instances the leukocyte count is of great diagnostic aid. Blood counts should be made frequently and at regular intervals. A sharp rise of the count provided that other causes of leukocytosis can be excluded, is then strong presumptive evidence of a supervening empyema.

Farmer, Moore, and Walker[1] have observed a peculiar behavior of leukocytes in very early examples of *carcinoma* in various parts of the human body. The phenomenon appeared to be mainly, if not entirely, restricted to cancer in its earlier stages, and did not occur in older growths, in metastases, or in grafts introduced into other individuals. In a rectal carcinoma, the size of a bean, it was found that there was a very distinct zone of transition from the normal to the cancerous elements around the periphery of the tumor immediately within the outer zone; the leukocytic crowding was more strikingly apparent and in a number of the cells it was easy to discern the presence of leukocytes which had invaded the epithelial cells where they stained readily. This phenomenon did not occur in the adjacent healthy tissue nor in the inflammation produced artificially. The most important, as well as the most singular factor lay in the fact that neither the leukocyte nor the invaded tissue cell appeared to be enlarged. In many instances it was found that both the leukocyte and the tissue cell were divided mitotically at the same time. The authors believe that a mixture of the chromosomes derived from the leukocyte and tissue cell respectively is distributed between the daughter nuclei resulting from the mytosis. In this way a complete distribution of the normal chromosome constituents of the cell will be effected and the distribution must be of a qualitative as well as of a quantitative character. What its relation to the ultimate reduction occurring in neoplastic cells may be is a subject for further investigation.

Sill[2] emphasizes the importance of a differential count and the enumeration of the polymorphonuclear leukocytes in *purulent affections*. He states that if both the leukocytic count and the polymorphonuclear count rise together, it indicates that the infection is growing more severe but that the resistance is rising pari passu. If they both fall together, it indicates that the body resistance has overcome the infection and the latter is on the decrease, but if the leukocyte count falls, while the poly-

[1] Lancet, August 15, 1905.
[2] Detroit Medical Journal, September, 1905.

morphonuclear remains high or rises, it indicates that the infection is spreading, and the resistance is being overcome. The outlook is then unfavorable.

Fettermann[1] emphasizes the fact that a high leukocytosis in the first days of *appendicitis* indicates that the organism is actively at work struggling with its invaders. An operation undertaken under these conditions has a good prognosis. His experience has been that a high leukocyte count indicates a severe infection but is no criterion as to the presence of pus.

Berndt[2] discusses the leukocyte count in appendicitis and states that it is of use to the surgeon only when positive. He thinks a continued high count above 25,000 can be relied on as meaning the presence of pus formation, but the absence of an increased leukocyte count can never be considered a proof that pus does not exits. He emphasizes the value of the leukocyte count as a factor in differentiating between appendicitis and typhoid fever.

Rogers[3] discusses the *leukopenia* occurring in *cachexial fever* and *kala-azar* and concludes:

1. A very marked decrease in leukocytes is always found in uncomplicated cases of cachexial fever and when they number below 2,000 per c.mm. this is almost diagnostic of the disease, but may rarely occur in true malarial cachexia.

2. In cachexial fever the leukocytes are reduced to a greater degree than the red corpuscles so that the ratio falls below 1: 1000 in all uncomplicated cases. This is rarely so in true malarial cachexia while a reduction in the ratio to below 1:1500 appears to be quite diagnostic of cachexial from other Indian fevers.

3. The most marked degrees of reduction of the leukocytes and especially of the polymorphonuclears is of bad prognostic import and vice versa.

4. Red bone-marrow tabloids are of great value in increasing the leukocytes and this increase may take place during the continuance for months of intermittent fever and be then followed by cessation of the fever and complete recovery.

5. High intermittent fever is accompanied by progressive deterioration of the blood and general condition, but it may be often to a large extent reduced to the less intermittent form by continued large doses of quinine combined with red marrow. The best results yet reported have been obtained by those who carry out vigorous quinine treatment.

Tileston and Locke[4] studied the blood of thirty-four cases of *scarlatina*, twenty-eight of whom were between the ages of two and ten years, one

[1] Münch. Med. Woch., 1904. li. No. 50.   [2] Ibid.
[3] British Medical Journal, April 1, 1905.
[4] Journal of Infectious Diseases, vol. ii. 1905.

under two years and the remaining five varying from eleven to twenty-three. The examinations were usually begun on the second or third day and continued until death in the fatal cases or until the establishment of complete convalescence in those ending in recovery. Only such cases were selected as gave unmistakable evidence of the disease and remained under a constant regime of diet and treatment. In no case was medication used other than small doses of strychnine and even that in but few. With absolute uniformity the blood was taken about 9.30 A.M. or 4 P.M. in order to avoid any possible influence by the ingestion of food. Sixteen of these cases were classified as mild, eleven moderate, and five severe in type. Tileston emphasizes the fact that any attempt at definite deduction regarding the number of blood cells occurring in the course of any disease must take into consideration the normal variations from year to year in infancy and early childhood. He states that the normal number of leukocytes in infancy varies from 10,000 to 15,000 per c.mm. dropping to about 12,000 per c.mm. in the second year and slowly decreasing to reach the normal adult value (7500 to 10,000 per c.mm.) at the tenth year. In children the lymphocytes were found to be somewhat increased with a corresponding decrease in the polynuclears as compared with adults, while slight or unknown causes produced marked changes.

The changes in the percentage of hemoglobin were somewhat irregular but commonly the value was at the beginning normal, later showing a tendency to gradual decrease. In several of the mild as well as the moderately severe cases, no appreciable diminution could be made out, while in others a loss of from 5 per cent. to 20 per cent. was noted. The severe cases so far as studied were uniformly accompanied by a loss of from 10 per cent. to 25 per cent. of hemoglobin. Complications, especially diphtheria and nephritis, often produced an abrupt loss in a few days of from 5 per cent. to 20 per cent. In uncomplicated cases the loss of hemoglobin was very gradual, occasionally reaching its lowest point only after several weeks, and more slowly mounting up to normal during convalescence.

The changes in the red cells were much less definite and constant than those described by other authors. At the onset the number of erythrocytes was almost invariably normal, 4,300,000 to 5,600,000 per c.mm. During the first few weeks of the disease, their course varied with the severity of the condition, in very mild cases usually not diminishing at all or even increasing; in the cases of moderate severity, sometimes falling from 100,000 to 700,000 per c.mm.; and in the severe types sinking much more abruptly and constantly, though in no instance more than 700,000. Among the uncomplicated cases, the lowest count recorded was 3,700,000 per c.mm. This, however, was in a debilitated child of

two and one-half years. The degree of leukocytosis varied so much with the age and severity of the disease that any general exact statement of the blood count in scarlatina is in the authors' opinion impossible. They, therefore, attempt to represent the course of the blood count in the various stages of the disease by combining the tabulated results into a composite curve excluding all such counts as appeared to be influenced by complications or other conditions. From this average count it was found that the leukocytosis rises somewhat during the first two days to 16,000 or 17,000 per c.mm.; then more suddenly on the third day to its maximum, 23,000 per c.mm. The leukocytosis falls slightly on the fourth and fifth, to rise again to 21,400 on the eleventh. Subsequently the general course was irregularly downward until at the end of the third week the count became about 12,000 to 14,000 per c.mm. During the fourth and fifth weeks, the curve was irregular but with a general tendency upward. As a rule the absolute number of mononuclear leukocytes was at first slightly increased and throughout the remainder of the disease greatly so. The eosinophiles were in the beginning either absent or much diminished but soon rose to slightly above normal values, often on the fourth or fifth day as high as 5 or 6 per cent.

Even during convalescence a continued or temporary high value was sometimes met. No especial changes in the percentage of the mast cells were noted except occasionally a slight decrease in the early stages of the disease followed in convalescence by a material increase. The number of blood platelets seemed to be extremely variable and without constant relation to the period or severity of the disease, although in several instances they were distinctly increased during early desquamation. In studying the effect of complications upon the blood in scarlatina, Tileston and Locke obtained surprisingly negative results. The cases of measles, local abscesses, endocarditis, otitis media serosa, and typhoid fever produced no definite alterations in the blood. Two cases of otitis media purulenta gave a slight increase in the leukocytosis with a corresponding rise in the percentage of polynuclear leukocytes. One case of diphtheria produced similar changes, but of only very moderate degree. In one case in which nephritis developed on the twenty-second day of the disease, the leukocytic count, made immediately after the onset of symptoms, increased in number from 17,500 to 20,800, with an increase in the percentage of polynuclears from 67.50 per cent. to 72.50 per cent. Three days later the blood count rose to 25,900, and the neutrophiles to 74.25 per cent. With the subsidence of the symptoms, both diminished rapidly. Of the ten cases of cervical adenitis occurring in the course of scarlatina, three apparently produced a marked increase in the white count and neutrophiles. The white

count finally approximated normal limits in the sixth or seventh week. Striking exceptions to this general course were found in some of the cases. Those of a very mild type, as a rule, showed a less intense leukocytosis which was shorter in duration, while many of the very severe cases on the other hand gave much higher values which were sustained for a longer time. While the results were not absolutely constant, the authors believe that within certain limits the degree of leukocytosis bears a direct relation to the severity of the disease and that the duration of the leukocytosis bears a corresponding relation to the gravity of the symptoms. The maximum leukocytosis seemed to correspond quite closely in time with the highest temperature, but appeared from one to two days earlier and persisted from a few days to several weeks longer and during the course of the disease was not influenced by the character of the fever curve. The course of the different counts of leukocytosis presented considerable variation in a few individual cases but considered altogether they conform to a uniform type. The polynuclears were during the first few days of the disease relatively much increased, reaching the maximum 80 per cent., to 95 per cent. on the second to the eighth day, to fall abruptly, then gradually to normal or subnormal at the end of the third to the sixth week. Absolutely these cells first took almost precisely the same course but later fell more rapidly. During the first week, the absolute value ran parallel with a total leukocytosis but subsequently sank more abruptly, due to the increase in the mononuclears. Never, however, in contrast to the percentage value did the number of neutrophiles become subnormal. Both relatively and absolutely the mononuclear cells took a direction complimentary to the polynuclears. From a normal percentage at the onset they quickly fell on the second to the fourth day to even 4 per cent. or 5 per cent. in extreme cases, rose to normal during the next few days and for the following few weeks more slowly to 50 per cent. or higher. Convalescence was thus characterized by a mononucleosis which persisted for many weeks.

Tileston and Locke conclude: First that the blood of scarlatina in children differs from that in adults only in proportion to the differences in normal blood at different ages. Second, that a slight secondary anæmia is the rule in all but the very mild cases and varies directly with the severity and duration of the disease; the fall in hemoglobin being from 5 per cent. to 25 per cent., in the erythrocytes from 100,000 to 700,000 per c.mm., both returning to normal after a period of several weeks. Third, that a hyperleukocytosis almost invariably accompanies the disease, and runs a characteristic course, rising abruptly on the second to eighth day to 18,000 to 40,000 per c.mm. and falling rapidly for a few days, then more gradually to reach the normal in convales-

cence usually at the end of from three to six weeks. Fourth, that during the period of invasion and eruption, the polynuclear leukocytes are both relatively and absolutely increased, but decrease gradually with the fall in the leukocytosis until convalescence, when they become relatively, though never absolutely below normal. The mononuclears take an exactly opposite course, and with the onset, the eosinophiles disappear entirely or are greatly reduced to rise above normal when defervescence begins, this eosinophilia persisting until late convalescence. The myelocytes are often seen in small numbers as in all infectious diseases. Fifth, that complications with a few exceptions exert no influence upon the course of the blood. If severe they may increase the anæmia and in a few instances (nephritis and diphtheria) even produce a rise in the leukocytosis.

Eosinophilia. Many views as to the origin of these cells have been put forth. Some observers believe that leukocytes with these coarse granules are derived from those with fine granules. Others (Ehrlich) that they are transformed connective tissue cells; others that they are formed in the bronchial or intestinal mucosa. Another view that the eosinophile granules are formed from material ingested by leukocytes seems to have more support. Acidophile substance formed from nuclei undergoing degeneration is ingested by phagocytes.

Teichmuller,[1] repeating experiments which Heidenheim[2] tried in studying the number of eosinophiles in the villi of the intestine, concluded that starvation causes a temporary increase followed by a diminution of the eosinophiles. This diminution was not found to take place in the bone-marrow.

In human muscle infected with trichinae, T. R. Brown[3] found both neutrophile and eosinophilic leukocytes in contact with the much-altered muscle fibres. Finding what he thought to be transitional stages, he concluded that probably the neutrophilic formed the eosinophilic granules by ingesting degenerated muscle fibre, and in trichinosis, when eosinophiles were markedly increased in the circulating blood, the neutrophilic leukocytes had undergone a corresponding diminution in number.

Metschnikoff[4] has noticed spirilla of cholera, taken up by leukocytes of the guinea-pig, become altered so as to take the acid stain, while Mesnil[5] believes anthrax bacilli are taken up and transformed into eosinophile granules by the lizard. Opie[6] believes that the origin of the eosinophile from the eosinophilic myelocytes in the bone-marrow represents

[1] Deutsch. Arch. f. klin. Med., 1898, vol. lx. p. 576.
[2] Pflüger's Archiv f. Phys., 1888, vol. xliii. Suppl. Heft.
[3] Journal of Experimental Medicine, 1898, vol. iii. p. 315.
[4] Annales de l'Institut Pasteur, vol. viii. p. 58, 1894.
[5] Ibid., vol. ix. p. 301, 1895.
[6] American Journal of the Medical Sciences, February, 1904.

an analogous phenomenon to the origin of the polymorphoneutrophiles from the neutrophilic myelocytes, and that they reach the tissues by way of the bloodvessels, passing through their walls.

In Opie's[1] second experiments, studying the relation of eosinophiles to an animal parasite, small pieces of pork infected by trichinæ were teased in glycerin containing 5 per cent. acid and pressed between two glass slides and the encapsulated trichinæ examined under low power.

Small pieces of the pork found to contain about 2000 trichinæ, after being ingested by guinea pigs, increased the eosinophiles to 15 per cent. or so, on about the twenty-fifth day, while at the sixty-fifth day, the number had again fallen to 1 per cent. and the animal had recovered. Thus the eosinophiles are in largest numbers in the circulation at about the time when, according to Leuckart,[2] the embryonic trichinæ are passing in great numbers from the intestine to the muscles.

Opie believes that an increase of the eosinophile cell in the bone-marrow causes other cells in part to be displaced and retards the multiplication of the polymorpholeukocytes, so that the number of the latter in the blood diminishes; and that it is unnecessary to assume, as does Brown, that the diminution is due to transformation of the neutrophile into the eosinophile. In the bone-marrow there is also a decrease in the amount of fat, as in bacterial infection causing a leukocytosis. Mild infection by the trichina stimulates the eosinophile cells to active multiplication, but severe infection causes degenerative changes and their destruction.

Opie,[3] in his third paper, studying the relation of the eosinophile cells to bacterial infection, concluded that certain bacteria (bacillus tuberculosis, bacillus cholera suis) producing somewhat chronic, fatal infection in guinea-pigs cause the eosinophilic leukocytes to gradually disappear from the circulating blood.

After the inoculation of an organism (bacillus pyocyaneus) producing an infection from which the animal is capable of recovering, eosinophilic leukocytes disappear from the peripheral circulation, so that their proportion may fall from 5 or 10 per cent. to less than 1 per cent. The number of eosinophilic leukocytes then increases, and at the end of four or five days both the relative and absolute number of these cells may considerably exceed that present in the peripheral circulation before inoculation. At the end of six or seven days the number of eosinophilic leukocytes is again normal.

Under the influence of severe bacterial infection, eosinophilic myelocytes together with other elements, usually regarded as characteristic of the bone-marrow, accumulate in the spleen and may be found in the

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[1] American Journal of the Medical Sciences, vol. cxxvii. p. 477.

[2] Die Menschlichen Parasiten, Leipsic and Heidelberg, 1876, vol. ii.

[3] American Journal of the Medical Sciences, vol. cxxvii. p. 988.

circulating blood. The occurrence of this phenomenon within from two to four hours after inoculation demonstrates that these elements are derived from the bone-marrow and are not formed in the spleen. Myelocytes with both fine and coarse (eosinophilic) granulations, which have found their way to the spleen, here multiply by karyokinetic division.

Bacteria exert a chemotactic influence upon cells with eosinophilic granulation, attracting them from the circulating blood to the site of inoculation and from the bone-marrow into the blood. Eosinophilic leukocytes, like the finely granular polynuclear leukocytes, accumulate in the neighborhood of bacteria injected into the body and, though they rarely act as phagocytes, have a part in the series of changes which follow bacterial invasion.

J. Morgan Coffin,[1] in his article on "Tropical Liver Abscesses," notes a slight increase in the percentage of eosinophilic, and especially considers the leukocytosis as a valuable guide in the diagnosis, while H. M. Snyder[2] also noted an increase in the eosinophiles in *amœbic dysentery*.

C. J. Fauconnet[3] noted eosinophilia due to tuberculin fever, and W. T. Cummins,[4] in a study of the blood in cases inoculated with tuberculous serum, also found an eosinophilia. W. T. Longcope[5] noted the great number of eosinophiles in the bone-marrow, with other widely distributed situations, in a fatal case of Hodgkin's disease with general eosinophilia.

Zappert,[6] believes that eosinophilia occurs in the group of post-leukocytosis, with which Ehrlich agrees.

Leichtenstein observed 72 per cent. eosinophiles in the blood of a patient with ankylostoma and during a croupous pneumonia which the patient had, these cells fell to 6 or 7 per cent., and after the clearing up of this disease, rose again to 54 per cent. He believes that when the condition of the eosinophiles before an acute fever is not known, that it is not possible to call a then appearing eosinophilia post-febrile, until all other possible causes have been excluded and especially an eosinophilia existing before the fever.

L. N. Boston reports a case of *chyloric ascites* with eosinophilia from which he excluded trichinosis by a careful study of parts of the soleus muscle. In several differential counts, ranging from a few days to four weeks apart, the eosinophiles varied from 10 per cent. to 5.5 per cent. to 13.3 per cent., while the red blood corpuscles steadily decreased, and toward the end basic granulations and nuclei appeared in some of the red cells.

[1] American Medicine, January 27, 1906.
[2] Proceedings of Pathological Society of Phila., March 8, 1906.
[3] Deutsch. Archiv f. klin. Med., vol. lxxxii. No. 6.
[4] Proceedings of Philadelphia Pathological Society, March 8, 1906.
[5] Ibid.
[6] Skandinav. Archiv; Zeitschrift f. klin. Med., 1893, Bd. xxiii. p. 296.

Iodophilia. The interest in the reaction known as iodophilia, in which the protoplasm of the leukocytes, especially those of the polymorphonuclear type, shows a peculiar susceptibility to the action of iodine, has during the past year or so again been more manifest. Several works on laboratory or clinical diagnosis, in their latest editions, have included a reference to the condition and to the method of detection, and several articles have appeared upon the subject, notably the ones by Keen[1] and J. C. Da Costa, Jr.[2]

The technique of the method is still virtually the same as that suggested by Ehrlich[3] in 1883. Fresh, moist films of normal blood, exposed to iodine vapor before they have had time to dry, show the same dark brown or variable brown staining of the protoplasm of the leukocytes, that is seen in dried blood films from certain diseased conditions. Wolff[4] believes that some substance, susceptible to the action of iodine, probably cellular glycogen, is present in the circulating leukocytes, which owing to its extreme solubility, is not present in dried films of normal blood, but is made insoluble by certain toxins and its presence is thus able to be demonstrated. Sorochowitsch[5] suggests that while normal cellular glycogen is transformed into glucose by the action of certain ferments, when there is a toxin interference with the activity of these ferments, the glycogen accumulates within the leukocytes in sufficient quantity to be recognized.

Therefore, air-dried blood spreads, unfixed, are treated with a reagent, made up of one part iodine, five parts potassium iodide and one hundred parts of distilled water, to which fifty parts of gum arabic are added, the entire process consisting in mounting the cover-glass upon a glass slide by means of a drop of this reagent and in examining after five minutes under the microscope with an oil immersion lens. The "Vital Iodine Fixation Method," consisting of exposure of the dried film to the fumes from iodine crystals for five minutes and mounting in levulose, as recommended by Zollikofer,[6] also gives satisfactory results. The exposure for several hours, in either test, does not seem to produce a more intense reaction.

Da Costa[7] obtained blood films from one hundred patients suffering from various acute infections and chronic disorders and in fifty of these made counts of the erythrocytes and of the leukocytes (absolute and differential) and hemoglobin estimations.   In addition, blood films from twenty healthy individuals were examined as a preliminary step and later, others,

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[1] Rapports Prem. Cong. de la Soc. Internat. de Chir., Bruxelles, 1905, 16.
[2] Proceedings Philadelphia Pathological Society, December 28, 1905.
[3] Zeitschrift f. Klin. Med., 1883, vi. 33.
[4] Ibid., 1904, li. 407.   [5] Ibid., li. 245.
[6] Inaug. Dissertation, Berlin, 1899.   [7] Loc. cit.

as controls, and the result was uniformly negative for iodophilia. In fifty of the positive reactions, the percentage of iodophiles and of the different types of such cells, was calculated, twenty-five showing simple diffuse staining, the color ranging from a delicate shade of tan to a deep mahogany red; twenty-four a diffuse discoloration plus a granular stippling, almost black in places, and the remaining single case showing purely granular mottling of the protoplasm alone. In the diffuse type the deepest coloring is generally observed in the neighborhood of the nucleus and at the periphery of the cell, the intervening protoplasm being either of a diffuse lighter brown shade, as is the rule in reactions of moderate intensity, or blotched irregularly with deeper mahogany colored areas upon a paler undertone, as is the general finding in reactions of more striking intensity.

In the granular type, the individual granules varying in size from that of the most delicate neutrophile to that of the coarsest mast cells, are usually oval or spherical in shape, and are distributed generally toward the periphery of the cell. They never fuse into a conglomerate mass. Beside the polymorphonuclear leukocytes, the lymphocytes, especially the small variety, occasionally are iodophilous, with usually three or four small coarse deep mahogany colored spheres, springing from their outer margin and contrasting with the scanty rim of cell body. Neutrophilic myelocytes are also occasionally affected and eosinophiles have twice been observed to show iodophilia by Da Costa and once by Zollikofer. In blood from a case of acute lymphatic leukæmia, in which many lymphocytes were undergoing mitosis, Da Costa demonstrated in several of these cells, both in those with monaster and diaster figures, fine iodophilous granules and diffuse iodophilia of the polymorphonuclear neutrophiles. The frankly degenerated leukocyte, so long as it remained structurally intact, did not show any reaction.

The degree of iodophilia in any given blood film, reacting positively, is determined partly by the activity of the toxæmia in the individual case and partly by the inherent vulnerability of the cells. An abundance of deeply stained cells is commonly met with in septic cases with febrile disturbances, prostration and other signs of severe infection, and in such instances it seems reasonable to regard the reaction as a rough gage of toxæmia. Well-defined iodophilia may also occur in those who suffer from non-septic diseases, and who, though acutely ill, show no signs of grave systemic intoxication. In these cases the cells may thus manifest a pathologically hypersensitiveness.

The mere question of leukocytosis has not the slightest bearing upon the production of iodophilia. Toxæmia, not the leukocyte range, is the factor of the reaction, which makes it easy to understand why the blood of a profoundly septic patient may show a decided leukopenia with intense

iodophilia, while high leukocytosis without iodophilia may be found in a disease exciting a toxæmia sufficient to stimulate the overproduction of leukocytes, but not intense enough, nor of the character requisite to effect them structurally. But iodophilia is far more frequent with leukocytosis than with normal counts, because leukocytosis is caused by more or less toxæmia, Da Costa's cases showing that 88.5 per cent. of those cases showing leukocytosis, gave a positive iodine reaction. And usually, although not in every individual case, the higher the polymorphonuclear percentage, the more intense the iodophilia, as this grade of iodophilia is very commonly accompanied by absolute leukocytosis, which means a higher number of polymorphonuclears, the very cells most susceptible to iodine. Locke[1] believes it to be a more reliable indication of the intensity of the infection than the number of leukocytes.

As opposed to this, F. E. Sondern, of New York, believes that the value of the finding of iodophilia is quite secondary to the relative differential and total leukocyte count, in estimating the character and severity of an inflammatory process.

Kaminer[2] has shown that in normal animals the neutrophiles of the bone-marrow never show the slightest evidence of susceptibility to iodine, while in animals showing iodophilia in the peripheral circulating polymorphonuclears, similar changes are found in the bone-marrow and Da Costa has observed in a case of acute lymphatic leukæmia, iodophilia both in the polymorphonuclear leukocytes and in the lymphocytes of the circulating blood during life and of the bone-marrow after death.

Da Costa sums up the results of his careful research as follows:

1. In the dry blood film, intracellular iodophilia indicates a form of leukocytic degeneration of toxic origin, and due presumably to an abnormal affinity of the cell glycogen for iodine. The same reaction in the fresh wet-blood film is physiological. Extracellular iodine-stained masses in the plasma have no definite pathological significance, so far as can be determined.

2. The toxic factor of the reaction may be absolute and frankly demonstrable, as in pyogenic septicæmia and in pneumonia; or it may be indefinite and masked as in pernicious anæmia and in cachectic states.

3. The reaction is restricted to the cytoplasm of the leukocytes, never affecting their nuclear structures. In fully 98 per cent. of all reactions the polynuclear neutrophiles are implicated; in about 20 per cent. other cells, notably the lymphocytes and less commonly the myelocytes also react, and in exceptional instances, iodophilous eosinophiles are noted. Diffuse and diffusely granular brown staining are the prevailing microchemical changes, pure granular stippling being exceedingly rare.

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[1] Boston Medical and Surgical Journal, September 11, 1902.
[2] Zeitschrift f. Klin. Med., 1902, xlvii. 408.

4. The number of iodine-stained cells corresponds roughly to the color intensity of the reaction, fifty per cent. or higher of iodophilia being generally found in a decided, and approximately twenty-five per cent. in a feeble reaction.

5. Iodophilia has no direct relation to leukocytosis, to anæmia or to pyrexia. (*a*) Its relative frequency with high leukocyte figures is due to the fact that such cases are generally toxic; a similar toxæmia with leukopenia excites just as intense a reaction. (*b*) The grade of anæmia in no wise corresponds to the incidence or to the intensity of the reaction. (*c*) Fever, per se, has absolutely no effect in causing iodophilia, afebrile cases and those with hyperpyrexia showing an equal percentage of positive results.

6. From a clinical viewpoint, iodophilia is often a helpful though under no circumstances a diagnostic sign, and to be of real service to the clinician it should be correlated with every other detail of the clinical picture. Thus interpreted, a positive reaction in a person obviously ill means that the systemic effect of the illness, whatever it may be, is vigorously exerted in so far as its harmfulness to the patient in question is concerned; in this connection the sign is useful in the study of such diseases as enteric fever, pneumonia, diphtheria, general sepsis, and many of the severe cachexias. Especially is iodophilia significant when associated with a leukopenia symptomatic of overwhelming prostration of the individual; iodophilia plus leukocytosis indicates simply an intense infection with an adequate systemic counteraction.

In the differentiation of various specific clinical entities, one must be extremely cautious in accepting iodophilia as a criterion. Da Costa, however, found the test corroborative in differentiating both gonorrhœal arthritis (bearing out the observations already recorded by Locke[1] and Sorochowitsch[2]) and osteomyelitis from rheumatic fever; pure tuberculosis from tuberculosis with secondary pyogenic invasion; ovarian abscess from ovarian cyst; and amyloid liver from fatty cirrhotic liver. In distinguishing purulent from non-purulent lesions, it must be recalled that the former always gives a positive reaction, unless the abscess is so effectually walled off that toxins cannot reach the circulation; and that the latter give a negative reaction, unless there happens to be some other source of toxæmia at work. These possible sources of error are extremely exceptionable, but it cannot be denied that they must be heeded in occasional instances.

Bone-marrow in Typhoid Fever and other Acute Infections. Longcope[3] reports the bone-marrow findings in typhoid fever and other acute

[1] Loc. cit.   [2] Loc. cit.
[3] Bulletin of the Ayer Clinical Laboratory of the Pennsylvania Hospital, January, 1905, No. 2.

infections which are of special interest as an addition to the investigation of the close relationship that has been shown to exist between cells of the hemopoietic organs and the cells of the circulating blood. The bone-marrow was examined in twenty-six cases of typhoid fever and for comparison in fifteen cases of pneumonia, four of peritonitis, two of miliary tuberculosis, one of acute cerebrospinal meningitis, one of retroperitoneal abscess, one of puerperal septicæmia, four of chronic nephritis, one of carcinoma of the gall-bladder, and two of normal individuals. In most instances the marrow from the upper third of the femur was studied both in sections and in smear preparations. The normal marrow was obtained from the lower end of the tibia. One of these patients was thirteen, the other about twenty-three years of age. During life, the conditions and numbers of the leukocytes in these cases were studied as far as possible. An attempt was made to procure at least several leukocyte counts from all cases; the period of observation extending over several days before death. Longcope calls attention to the importance of cell differentiation in addition to the study of the structure of the bone-marrow. By means of various stains he was able to recognize in the sections as well as in smear preparations, aside from the nucleated and non-nucleated red corpuscles, cells belonging to different groups. To designate these groups he used the following terms:

(a) *Granular Cells.* Neutrophilic granular myelocyte, a rather large cell but usually varying somewhat in size, containing a round or oval, palely staining nucleus, poor in chromatin, and presenting a cytoplasm filled with small granules taking a pinkish or violet stain in polychrome methylene blue and eosin.

Eosinophilic granular myelocytes, cells similar to the neutrophilic variety except that the granules are larger and stain bright red in eosin.

Certain transitional forms which contain either type of granule, but have an indented or slightly irregular nucleus.

Neutrophilic polymorphonuclear leukocytes.

Eosinophilic polymorphonuclear leukocytes.

Basophilic cells, with oval or irregular nucleus and protoplasm filled with large granules staining deep blue in methylene blue.

(b) *Non-granular Cells.* Large lymphocytes; large round cells about the size of a granular myelocyte with large round nucleus rather rich in chromatin, surrounded by a narrow rim of protoplasm taking a definite basophilic stain.

Small lymphocytes, cells indistinguishable morphologically from the small lymphocyte of the lymph node.

Between the last two groups, however, many border-line cells were seen; cells somewhat larger than the small lymphocyte with slightly richer protoplasm; and, indeed between the large lymphocyte and the

granular myelocyte there were also elements which could not with surety be placed in either group. In general morphology, these resemble the large lymphocyte except that the protoplasm contained a few definite neutrophilic granules.

NORMAL BONE-MARROW. The marrow from the tibia of a man aged twenty-three years was entirely fatty and contained much cancellated bone. Sections showed only a few cells scattered about the periphery. These were principally granular myelocytes and polymorphonuclear leukocytes, while an occasional large lymphocyte or small lymphocyte was seen here and there.

In the case of a child, the marrow was fatty in the shaft of the tibia, but toward the lower end it was reddish. Throughout the marrow there was much cancellated bone. Sections through the central part showed nothing but fat and small pieces of bone. Between the fat cells congested vessels were seen. In a few sections made through the periphery of the bone-marrow near the lower end of the bone, there were many blood forming cells. Fat and bone were always present. The marrow cells were found in small clumps and patches. Many different types of cells could be made out, and while the different cells were mingled together in a certain degree, yet in most of the clumps and patches one variety of cell seemed to predominate over the others. Granular myelocytes were comparatively numerous, and with the polymorphonuclear leukocytes, which perhaps outnumbered any other type of cell, made up many of the cellular patches. Among these there were considerable quantities of mononuclear eosinophiles. Granular myelocytes with irregular nuclei were quite common. The typical large lymphocyte with round nucleus and marrow rim of basophilic protoplasm was quite rare. Small lymphocytes were much more numerous and formed a fair proportion of the cells. It was most usual to see them in small loose patches, but occasionally they were scattered among the other cell types. No definite lymphoid follicles were observed. Nucleated red cells were quite numerous, and almost without exception formed small tight clumps in which there were practically no other cell elements. A few megaloblasts were seen, but most of the nucleated red blood corpuscles were normoblasts. Multinucleated giant cells were extremely scarce. No large phagocytic cells were met with.

TYPHOID FEVER. In eleven of the twenty-six cases of typhoid fever no complicating infection could be discovered at autopsy, except that in a few instances there was a slight acute bronchopneumonia. The individuals varied from fifteen to thirty-four years of age. The length of the attack was from six to thirty-one days.

The macroscopic appearance of the bone-marrow differed a little in the various cases. Usually the marrow in the midportion of the femur

was fatty, becoming mottled or patched with red areas toward the upper end of the bone. In one instance, the youngest individual aged fifteen years, it was red throughout and contained much cancellated bone. Often it was quite soft, while toward the upper end of the femur the color was a dirty grayish red.

Sections revealed certain constant and striking changes, though the severity of these lesions was not always of the same grade. In all cases the marrow showed marked congestion, while the lymph spaces were more or less distended with coagulated material taking a pink stain in eosin. The central portion of the marrow was, as a rule, made up of fat cells, while about the periphery cells of many different types formed a loose patchy network between the fat cells. Occasionally the proliferation of cells about the extreme periphery was sufficient to form a narrow rim of tissue free from fat, where, however, the individual marrow cells were well separated by blood and coagulated serum. When these patchy cellular areas were carefully studied by means of several different stains, it was found that they were composed of a great variety of elements. Typical granular myelocytes were seen in moderate numbers, but never appeared in excess, and sometimes did not even equal in numbers the total cellular constituents. They were usually scattered among the other cells, but sometimes could be seen in small loose clumps. Eosinophiles were distinctly rare. A few cells having the character of granular myelocytes, except that the nucleus was indented or a little irregular, were often noted in the different sections. Polymorphonuclear leukocytes were always present in fairly large numbers, and sometimes were quite numerous.

Almost as numerous as the granular were the non-granular cells, and indeed, in two cases where the disease had lasted for more than three weeks the non-granular elements exceeded the granular cells in numbers. The small lymphoid cells predominated. These cells were scattered diffusely through the sections or were gathered together occasionally in small loose clumps. In many sections definite lymphoid follicles were found resembling in a rough way the Malpighian bodies of the spleen. Sometimes they were pierced by a central vessel, but germinal centres were never observed. These lymphoid follicles were made up almost exclusively of small lymphocytes indistinguishable histologically from the small lymphocytes of the lymph glands. In a few instances the cells were tightly packed together, but more often the follicles had a loose structure, and between the cells a very delicate reticulum could be made out. Upon this lay large irregular cells of endothelial type. Some of these follicles were so large that they could readily be seen with the naked eye as small blue dots in the section. Much less numerous than the small lymphoid cells were the large lymphoid elements. They often occurred

in small clumps of four to six cells and were also scattered irregularly through the sections. Not infrequently lymphoid cells were seen which could not be identified with either of these types, but varied in size and appearance between the two. A very few basophilic cells of another type were found. These cells were slightly irregular or more or less triangular in shape, a small, round, deeply staining nucleus being placed in one angle of the triangle. The protoplasm contained no granules and took a deep blue stain in polychrome methylene blue. The appearance was much that of a plasma cell. Nucleated red blood cells were always present in fair numbers and were sometimes quite numerous. They were clumped in small tight groups. Most of them were normoblasts, but a few megaloblasts were also noted both in smear preparations and in sections. Only when nucleated red cells were particularly plentiful could megaloblasts be found. One specially prominent feature of the sections was the presence of large, irregular, phagocytic cells. These cells were frequently seen in abundance and made a striking picture. They were much larger than the granular myelocytes, were irregular in shape, and possessed a rich cytoplasm taking an even, deep-pink stain in eosin. The nucleus was oval or round, eccentrically placed, and stained lightly in nuclear stains. Many of these cells were scattered among the blood-forming cells or lay between the fat cells. Not infrequently they were crowded together in the blood spaces or lymphatics. Often they appeared to lie upon a delicate reticular network which ran between the marrow cells and could readily be demonstrated with Mallory's connective-tissue stain. Engulfed within the protoplasm were nucleated and non-nucleated red blood corpuscles, polymorphonuclear leukocytes, small lymphocytes, nuclear fragments or small granules of blood pigment. Owing to their frequent and close connection with the delicate reticular network Longcope thinks that these phagocytes take their origin from the endothelium of the reticulum. Finally, the large multinuclear giant cells of the marrow were quite numerous in many sections.

Aside from these changes in the various types of cells another constant and striking lesion was found. This consisted in disseminated foci of necrosis. Often several of these areas were seen in one section; in other instances they were not so plentiful. They were seen both in the cellular and fatty portions of the marrow. The smallest areas appeared as a collection of six to twenty cells, the structure of which could not be well made out. The cell protoplasm stained deeply in eosin, while the nuclei were misshapen and either stained very palely or not at all in hematoxylin. Infiltrating the area were delicate strands of fibrin well brought out by Weigert's method. Occasionally a few red blood cells were found in the area. At times the large phagocytic cells were seen partially plugging the blood spaces immediately about these small

areas, and rarely a few polymorphonuclear leukocytes either infiltrated the focus or surrounded it. Neither one of these features was, however, constant. In the larger areas the necrotic cells gradually became hidden by the increasing density of the fibrin until finally the largest foci appeared as dense areas of coagulation necrosis richly infiltrated with a fibrin mesh. They were well isolated, especially when situated in the fatty portions of the marrow.

Longcope believes that the origin of these foci of necrosis is best explained by Fraenkel, who attributes them to a soluble typhoid toxin which causes necrosis of the marrow cells and destroys the walls of the lymphatics permitting an escape of lymph by which means the fibrin is formed.

Besides the definite and typical foci of necrosis, hemorrhages were sometimes noted.

In these eleven cases of uncomplicated typhoid fever the bone-marrow showed changes which in a way were analogous to those seen in the spleen and lymph glands in this disease. Briefly, there was a slight general hyperplasia of all the bone-marrow cells with special prominence of the non-granular lymphoid cells, and particularly of the small lymphocytes, enlargement of definite lymphoid follicles, presence of large phagocytic cells, and multiple foci of necrosis. There was also much congestion, some œdema and slight hemorrhage. By actual differential counts the proportion of non-granular and granular cells was often equal. In one case the granular myelocytes and polymorphonuclear leukocytes formed together 49.6 per cent. of the total number of cells, while the small and large lymphocytes composed 48.2 per cent. Except in one or two instances polymorphonuclear leukocytes were seen in goodly numbers and usually made up about 10 per cent. of the total number of cells. In one case they were quite scarce. This patient before death showed a leukocyte count of 10,100, with a percentage of 72.8 per cent. polymorphonuclear leukocytes. Previous to this terminal rise the leukocytes had been 5500. In one other case the leukocytes were 11,500 before death, in two cases they were not counted, and during the course of the other six cases the number of leukocytes remained below 6000.

A more or less direct relationship existed between the extent of the changes in the bone-marrow and the severity of the lesions in the intestines, spleen, and lymph glands.

Of the cases complicated by a secondary infection, eight died of *general peritonitis following perforation.* The ages of the patients averaged from eleven to fifty years, the duration of the disease from fourteen to fifty-one days. The macroscopic appearance of the marrow varied from the mottled red and yellow character, seen in the uncomplicated cases, to a marrow which was soft, œdematous, free from cancellated bone, and deep red throughout the shaft of the femur.

Sections showed a picture similar in certain respects to that of the uncomplicated cases, but presenting interesting variations. Four of the marrows were practically alike. The marrow was intensely congested, and the lymph spaces were so widely distended with coagulated albumin that few cells remained. Scattered loosely through this congested and œdematous tissue were the marrow cells, being most numerous about the periphery of the sections. Many foci of necrosis were seen in the cellular portions and often involved large areas. The lymphoid cells were far more numerous than any other one element. Small lymphocytes were seen in great numbers and were either scattered diffusely through the sections or gathered in loose clumps. The large forms were present in fair numbers, but were much less numerous than the small lymphocytes. Not only were the granular myelocytes relatively decreased, but many of them showed degenerative changes. Although many cells were quite well preserved and karyokinetic figures were occasionally noted, the nuclei of other granular myelocytes were pyknotic or were swollen and stained scarcely at all. Sometimes the nucleus was distorted or showed fragmentation. These degenerated cells were scattered particularly through the more œdematous portions of the section, where the tissue had a washed-out appearance. Eosinophiles were scarce and while granular myelocytes with irregular nuclei were seen, typical polymorphonuclear leukocytes were almost entirely absent, only a few being scattered here and there. Large phagocytic cells occurred in profusion. Nucleated red cells were sometimes present in fair numbers. Throughout the sections small pyknotic nuclei, apparently without cell protoplasm, and nuclear fragments were often met with. It is to be noted that in three of these cases blood counts made during and after perforation showed only slight rise in the leukocytes varying from two to three thousand, while subsequently there was a progressive leukopenia. The highest count noted was 7500.

In the other four cases, though the changes in the marrow were of the same nature, the congestion and œdema were not so marked; the excess of lymphoid cells was not so great, and granular myelocytes and transitional cells were more numerous. The same poverty of polymorphonuclear leukocytes was noted. In one case where the marrow contained much fat and the granular myelocytes greatly exceeded the other cells in numbers, the lesions in the other organs were of very mild grade. A single ulcer of the ileum had perforated. At the time of perforation the leukocytes were 11,300; two days later they were 12,000. A complication which occurred in three cases was acute *lobar pneumonia*.

The ages of the patients were twenty, twenty-two, and thirty years. In the first case the attack lasted twenty-eight days; in the second, twenty-three days, and in the third for several weeks. The bone-marrow in

every instance was deep red practically throughout the length of the femur. Sections from the three cases showed very nearly the same appearance. The marrows contained many cells, and in places were converted into solid tissue. But in spite of the density of the tissue there was much congestion, some œdema, and many foci of necrosis, together with occasional hemorrhages. Granular myelocytes were abundant and occurred in greater total quantity than in any of the other cases. But the hyperplasia was by no means restricted to the granular cells, for lymphoid cells were enormously increased in numbers. In the marrow from one case they formed 55.1 per cent. of the total number of cells. Of the lymphoid cells the small lymphocytes predominated. As in the cases of perforation, polymorphonuclear leukocytes were noticeably scarce. The typical large phagocytes were seen in profusion, filling blood spaces and lymphatics and lying in small collections. Lymphoid follicles the size of Malpighian bodies were noted in one case.

Thus the same general characteristics were found as in the other cases of typhoid fever, for, though the marrow was much more cellular and the total number of myelocytes was greater, the same relative proportions existed between these cells and the lymphoid elements.

In two of these cases the leukocytes were not counted after the onset of the pneumonia, but previously to this time they were below 6000 per c.mm. In the third case the leukocytes during the latter part of the disease were below 6000 and remained below this level from the onset of the pneumonia until death.

The fourth group comprised four cases that showed at autopsy some secondary infection other than pneumonia or perforation. One patient died following an abortion, one patient had small abscesses of the prostate, and a third showed at autopsy a double fibrinous pleurisy with multiple small abscesses of the lung. The fourth patient during his attack developed tonsillitis and later otitis media. From the complicating infections in the last three cases staphylococcus pyogenes aureus was cultivated. The marrow in the first case presented a gross and histological picture exactly like that of the uncomplicated cases, except that the number of granular myelocytes was perhaps greater. In the other three instances the appearance of the marrow approached more closely the condition found in the perforation cases, congestion, œdema, phagocytosis, and focal necroses were pronounced. The loose cellular appearance of the sections was only in slight part dependent upon the hyperplasia of granular myelocytes. Large and small lymphocytes were seen in profusion, while many irregular basophilic cells were present. Nucleated red blood corpuscles were often very numerous. These changes were most noticeable in the second case. The attack had lasted for fifty days. The results of the blood counts during life were

as follows: thirty-first day of disease, white blood corpuscles, 4600; forty-fourth day of disease, white blood corpuscles, 5400; forty-fifth day of disease, white blood corpuscles, 5500; forty-eighth day of disease, white blood corpuscles 3700. On the forty-eighth day a differential count showed the following proportion of white cells; polymorphonuclear leukocytes, 48.4 per cent.; small mononuclear leukocytes, 42.0 per cent.; large mononuclear leukocytes, 7.6 per cent.; transitional cells, 2.0 per cent.

In the third and fourth cases only a single blood count was made during the attack. In one the leukocytes were 7300, in the other 5000.

In all of these twenty-six cases of typhoid fever the changes in the bone-marrow were the same in kind, though slightly different in degree. Congestion, œdema, focal necrosis, and the presence of many large phago-cytic cells was typical. A mild general hyperplasia of all the blood-forming cells, with always some and often a very decided relative increase of the non-granular cells and swelling of the lymphoid follicles, was a striking feature. There was usually a marked paucity of eosinophiles. In the uncomplicated cases polymorphonuclear leukocytes were abundant; in the cases complicated by acute infections these cells were much less numerous or practically absent. In those cases where the disease had lasted for three or four weeks the above lesions were more pronounced and the lymphoid hyperplasia was more marked than in the cases dying early in the attack. When perforation and general peritonitis were the causes of death the congestion, œdema, phagocytosis, and lymphoid hyperplasia were often extremely pronounced, while, besides the dissem-inated foci of necrosis, degeneration of single cells was noticeable. The marrow from cases dying of pneumonia, on the other hand, showed a greater hyperplasia of the blood-forming cells than was seen in any of the other groups. This hyperplasia sometimes resulted in the formation of almost a solid marrow, the granular myelocytes and lymphocytes occur-ring in about equal proportions.

PNEUMONIA. Of the sixteen cases of acute lobar pneumonia the marrow in two was red and firm throughout, in seven it was mottled red and yellow through the shaft of the femur, becoming entirely red and free from fat toward the upper third; in two the fat predominated although there was some red mottling; and in one case the marrow was completely fatty.

Microscopically the qualitative changes were much the same in all in-stances, although the quantitative alterations were variable. As a rule the marrow that appeared red macroscopically showed the greatest hyper-plasia of cells, and in the two instances where the marrow at autopsy was firm and red throughout, the fat was found to be almost entirely replaced by solid tissue. The hyperplasia was always more marked

about the periphery of the section, while toward the centre the cells were arranged in rather dense patches between the fat. Congestion was always more or less marked, and in a few instances was chiefly responsible for the red color. Œdema, on the other hand, was not especially noticeable and when present appeared of mild grade, while there was never anything to compare with the extreme distention of the lymph spaces so frequently noted in the typhoid marrows. The cells forming the patches were closely pressed together in solid masses. The cell which always predominated was the granular myelocyte. This cell, of round or oval shape with a rich protoplasm filled with small granules, taking a pinkish color in sections stained in polychrome methylene blue and eosin, and presenting a large round nucleus poor in chromatin, at first sight often seemed to make up the entire cell patches. Many cells with similar granular cytoplasm, but with irregular curved or indented nuclei, were also present. Many of the large granular myelocytes showed active proliferation and karyokinetic figures were numerous. The extreme paucity of polymorphonuclear leukocytes was always striking. Eosinophiles were never present in very large quantities. In comparison with these types of granular cells the non-granular varieties were distinctly rare. Here and there scattered through the cell clumps typical large lymphocytes were seen, the large round nucleus being surrounded by a narrow rim of basophilic protoplasm. Not infrequently three to five of these cells were seen in small clumps. The small lymphocytes were more numerous. These cells were dispersed through the tissue in an irregular manner, and while they sometimes formed indefinite groups, large lymphoid follicles like those noted in the typhoid cases were not often met with. In only two instances could well-defined but very small follicles be found. Cells of the plasma-cell type were always rare. After a long and careful search, a few of the large phagocytic cells which played such a prominent part in the typhoid marrows could be found in four or five sections. They usually contained blood pigment. Diffuse hemorrhages were noted in a few sections, but the foci of necrosis so typical of the typhoid marrows were not seen in a single instance. Multinucleated giant cells were fairly numerous. Nucleated red blood corpuscles were met with in varying numbers. In most cases they formed small compact clumps made up principally of normoblasts. Not infrequently the bloodvessels contained polymorphonuclear leukocytes, and sometimes they were loosely filled with these cells.

PERITONITIS. When the bone-marrows from the cases of peritonitis were examined, the changes were seen to be of the same character as those in the cases of pneumonia. In three instances the peritonitis was caused by a perforating gastric ulcer; in one instance by gangrenous appendicitis. Although the amount of cellular hyperplasia varied, the type was

always the same, for the cellular proliferation was confined principally to the neutrophilic granular myelocytes, which showed a striking relative increase above the other cells.' Numerous karyokinetic figures were present, and though typical polymorphonuclear leukocytes were scarce, granular myelocytes with irregular or indented nuclei were numerous. The sections gave the impression that myelocytes were being rapidly transformed into polymorphonuclear leukocytes, which were being as rapidly removed from the marrow. Whether the hyperplasia was slight or whether it was well marked, the cells always appeared in closely packed clumps or patches. Eosinophiles were never very numerous. Large lymphocytes were scarce, and small lymphocytes occurred only in small numbers, rarely if ever appearing in follicles. Certain cells were found which held a place intermediate between the large lymphocytes and granular myelocytes. Multinucleated giant cells were scarce, and the large phagocytic cells were almost entirely absent. Normoblasts were seen in moderate numbers and formed small compact clumps. No foci of necrosis could be discovered.

The marrows from the cases of meningitis, retroperitoneal abscess, puerperal septicæmia, and general streptococcus infection presented the same histological picture. The marrows from the cases of retroperitoneal abscess and general streptococcus infection were red and firm at autopsy and proved to be made up of solid tissue. In the other instances the marrow was mottled red and yellow macroscopically, and showed the usual patchy hyperplasia under the microscope. The relative proportions of the various blood-forming cells were the same as in the cases of pneumonia and peritonitis.

CHRONIC NEPHRITIS. Of the four cases of chronic nephritis three showed a fatty marrow. Throughout the femur there was much fat, and only toward the head could a little red mottling be seen. In the third instance, where an anæmia was associated with the nephritis, the marrow was firm and red throughout.

Sections in the first three cases approached very closely to the normal. Much fat was present and there was very little cellular hyperplasia. About the periphery, the cells formed small patches between the fat. Typical myelocytes were seen in moderate numbers; many granular cells with irregular nuclei were present, and polymorphonuclear leukocytes were quite abundant. In certain patches every transition between the large granular myelocyte with neutrophilic granules, and the typical polymorphonuclear leukocyte could be followed. Non-granular cells were seen in good proportion and occasionally they were present in some quantity. Frequently cells were seen which could not be well classified, and lay between the large and small lymphocytes or between the large lymphocytes and granular myelocytes. One or two small lymphoid

follicles were observed. Multinucleated giant cells were scarce. Plasma-like cells were occasionally noted. Rarely a large phagocytic epithelioid cell was found. A good many nucleated red blood corpuscles were seen, most of them occurring as usual in clumps. No foci of necrosis were observed.

In the third case the fat was entirely replaced by hyperplastic, blood-forming tissue. Granular myelocytes, transitional forms, and particularly polymorphonuclear leukocytes were very abundant. The relative numbers of these latter cells greatly exceeded anything that was seen in any other section. Large lymphocytes were fairly common; small lymphocytes were relatively rare.

The marrow from the case of carcinoma of the gall-bladder corresponded essentially to the normal type. There was practically no hyperplasia of the blood-forming cells, and the proportions and distribution of cells were the same as in the first three cases of chronic nephritis.

TUBERCULOSIS. In two cases of acute miliary tuberculosis the bone-marrow showed much the same appearance and resembled more than in any other condition the bone-marrow of typhoid fever. Macroscopically the marrow of the femur was principally fatty, with some red mottling. On microscopic examination sections of the marrow from the upper third of the femur showed about the periphery a slightly patchy hyperplasia, while toward the centre there was almost nothing but fat. Some congestion but very little œdema was noted. In the cellular patches there were moderate numbers of typical granular myelocytes, although these cells did not predominate greatly over other forms. A few granular myelocytes with irregular nuclei and quite a number of polymorphonuclear leukocytes were present. There were very few eosinophiles. Large, medium-sized, and small lymphoid cells were quite abundant; and in several sections, large lymphoid follicles were observed. Throughout the sections there were many large phagocytic cells, exactly like those found in the typhoid marrows. These cells occurred in the blood and lymph spaces as well as among the true marrow cells. They were often most numerous about the small tubercles which were scattered here and there through the sections. In one section a few small tubercles with necrotic centres were seen; and these foci, together with the other changes, gave a microscopic picture, which on superficial examination, might almost be mistaken for a typhoid marrow. Many multinucleated giant cells were seen. Nucleated red blood corpuscles were present in fair numbers, and as usual were collected in small close groups. Other than these small tubercles there were no foci of necrosis.

In comparing the appearance of typhoid bone-marrows with the marrows from the cases of pneumonia, peritonitis and the other acute infections, Longcope found changes which were so constant and sufficiently

distinctive as to separate the two groups. The lesions in the cases of pneumonia, peritonitis, meningitis, etc. were of the same character. This group may be considered as one type standing over against the cases of typhoid fever which showed lesions of an entirely different nature. He makes a third classification which includes the marrows from the first three cases of nephritis and the case of carcinoma of the gall-bladder; a group in which the histological picture does not differ essentially from the two normal marrows.

In the twenty-six cases of typhoid fever which were studied, the bone-marrow presented in general a mild hyperplasia of the blood-forming cells, marked congestion, and much oedema. Foci of necrosis were scattered throughout the sections. Quantities of large phagocytic cells were seen lying both in the blood and lymph spaces. The lymphoid follicles appeared to be fairly numerous and large. Above all, the cellular hyperplasia was especially characterized by a relative increase of the non-granular cells over the granular varieties. The marrows from the second group, including the cases of pneumonia, peritonitis, etc., showed as a rule, much greater cellular hyperplasia, some congestion, but slight oedema. No foci of necrosis were noted and phagocytic cells were almost entirely absent. There were very slight changes in the lymphoid follicles. The most important and indeed striking difference between the bone-marrow lesions in this group and those in the first, was seen in the marked relative increase of the granular cells over the non-granular varieties.

Longcope believes that there is a relationship between the cell contents of the marrow and the leukocytes of the circulating blood, since in typhoid fever the hyperplasia was mainly of a lymphoid character; while in the acute infections attended by a peripheral hyperleukocytosis, the hyperplasia consisted especially in an increase of the granular myelocytes. In general the hyperplasia of the leukoblastic tissue of the bone-marrow was directly related to the height and duration of the peripheral leukocytosis. On the other hand, the relative increase of granular myelocytes varied a little, that is, in certain cases of pneumonia, where the numbers of leukocytes in the peripheral circulation was scarcely above the normal, the percentage of granular myelocytes in the bone-marrow was very high. This hyperplasia of the granular myelocyte seem, therefore, to be essentially dependent upon the type of bacterial infection. The paucity of polymorphonuclear leukocytes was always striking. Certain variations, however, were noted. In two cases of pneumonia, where the leukocyte count during life was below normal, the bone-marrow at autopsy was almost entirely fatty, while in two other cases it showed red mottling. In one case where the leukocyte count was high, the marrow presented few cellular patches. In all of these instances the

relative proportion of granular myelocytes was high and polymorphonuclear leukocytes were rare or almost absent. Longcope offers as an explanation for this in three of the cases, the exhaustion of the functional activity of the marrow cells.

Contrasted to the hyperplasia of the granular cells in this group of infections was the hyperplasia of the non-granular cells found in the typhoid group. The striking feature in the histology of the blood in typhoid fever was a marked decrease in the total number of white cells with a diminution in the numbers of polymorphonuclear leukocytes and an increase in the numbers of lymphocytes, especially the large form of lymphocytes, the eosinophiles were greatly diminished or absent. This leukopenia was usually noticeable by the second week and in uncomplicated cases persisted through the attack into convalescence. With the onset of complications due to secondary infection, a hyperleukocytosis with elevation of the polymorphonuclear leukocytes may occur, but frequently the rise of white cells is not so great as in the same infection occurring as a primary condition and not as a complication of typhoid. The study of the bone-marrow and leukocytes of the circulating blood in this group of typhoid cases leads Longcope to consider that the hypoleukocytosis occurring in typhoid fever is due to an inhibition of the production of myelocytes caused by the typhoid toxin, and that this is a cessation of the normal function and not a destruction of the myeloblasts; since under certain conditions the marrow is capable of myeloid reaction as a response to the stimulus of a secondary non-typhoidal bacterial infection. This view coincides with that of Naegeli.

In Longcope's opinion, the lymphoid hyperplasia of the bone-marrow in typhoid fever not only seems to explain the hypoleukocytosis with mononuclear increase but it also seems to throw some light on the leukocytic reaction in complicating infections. He believes it is possible after hemorrhage, when it is fair to assume that the polymorphonuclear leukocytosis is a repair process for a loss of cells from the circulation, for the granular myelocytes to be capable of reacting sufficiently to overcome the damage; while in secondary infections it would seem that the primary typhoidal infection actually inhibits, to a certain extent, the formation of granular myelocytes and hence the production of polymorphonuclear leukocytes. In not one of the fifteen cases of typhoid fever complicated by secondary infections was there a very appreciable hyperleukocytosis. He looks upon this as being due to a possible functional disturbance of the large lymphocytes or premyelocytes which hampers the formation of granular myelocytes. The reaction of the granular myelocytes seemed to depend partly upon the severity or upon the type of secondary infection. In a complicating pneumonia where, as shown in this series of cases, there is a marked actual increase in

the numbers of granular myelocytes of the bone-marrow; these cells may be produced and may form adult polymorphonuclear leukocytes in sufficient quantity to supply the demand but not to exceed the number called for. Thus an equilibrium would be established and the peripheral blood show little or no total increase in polymorphonuclear leukocytes. If, however, there was an excessive local call for polymorphonuclear leukocytes, as well as a marked intoxication such as might occur in perforation, this blow to the series of granular cells, combined with the action of the typhoid infection upon the nongranular mononuclear series would, in Longcope's opinion, lead to profound functional disturbance of the bone-marrow cells; and with this partial functional destruction of the leukoblastic tissue, the progressive fall in leukocyte count, seen in many of the cases, may readily be understood.

Blood Changes in Acetanilid Poisoning. The attention which has been called to poisoning by the use of acetanilid, either as such, or in one of the proprietary headache tablets, during the past three years, has awakened the medical profession to the fact of its much more frequent occurrence than would otherwise have been suspected.

The committee on chemistry of the Council on Pharmacy and Chemistry of the American Medical Association reported the following percentage proportion of acetanilid in the named proprietary preparations, all of which were mixtures, not chemical compounds:

	Per cent.
Ammonol	50
Antikamnia	68
Kohler's headache powders	76
Orangeine	43
Phenalgin	57
Salacetin	43

Acetanilid is obtained as a colorless crystallized salt by the action of acetic acid on aniline and this is chemically phenylacetamid. It reduces temperature probably by converting oxyhæmoglobin into methæmoglobin in the red blood corpuscles and by interfering with oxidation.

Mention is made in PROGRESSIVE MEDICINE, December, 1905, by Landis, under "Acetanilid," of the case reported by the late D. D. Stewart[1] a few months before his death and of the two additional cases of poisoning by the use of this drug which were reported by me.[2]

The point of special interest involved is the blood condition, the picture of which, if its chocolate hue and its slight leukocytosis were disregarded, would resemble that of pernicious anæmia, as Ehrlich, Ludenthal, Krönig and I have noted.

[1] Journal of the American Medical Association, June 3, 1905.
[2] Ibid., July 22, 1905.

The reports seem to agree that a leukocytosis is present, the increase usually being in the polymorphonuclear elements. There were, however, in my two cases, which were uncomplicated, respectively— 37 per cent. and 35 per cent. of lymphocytes; but, coincident with an earlier case, there was an alveolar abscess while Hall's case showed bleeding hemorrhoids and a rectal fistula, and Cabot's case had a nasal catarrh.

Luca,[1] Stewart, Herrick, Probasci[2] and I have noted the patient's addiction to its use with a certain moral depravity, as was evidenced in the constant denial of its use. James B. Herrick[3] found nucleated reds in one of his cases which gave a blood count of 3,300,000 red blood corpuscles per c.mm., 12,000 leukocytes and 40 per cent. hemoglobin, with a color index of 50 and marked poikilocytosis. This patient absorbed the poison in the powder form, applied to a long-standing leg ulcer. Manasses[4] has also reported two cases showing symptoms of poisoning following the free use of acetanilid as a dusting powder on abraded surfaces in young children. The urine in Herrick's case was of a brownish color and contained paramido-phenol, which was found by Jaffe's indol-phenol test. I found similar changes by the same method, in the second of the additional cases reported a year ago. The blood had a marked abnormal brownish chocolate color, easily distinguished when films were made.

In Herrick's animal experimentations, using guinea-pigs and rabbits, he gave 10 grains of acetanilid daily over a period of ten weeks without any symptoms or blood findings of note. He then increased the dose to 20 grains, when the animals became weak in the hind legs and a purpuric spot appeared, followed by a few others. The red blood corpuscles became pale but no nucleated reds were found. One animal died, after a convulsion, on the thirteenth day. The spleen was not enlarged, weight 13 grams and showed a marked relative increase in connective tissue. None of the recently reported cases have shown as marked a blood picture as the first case reported by White and myself.[5]

H. C. Wood, Jr., has objected to the term "chronic," as the condition has been produced very quickly at successive intervals after the withdrawal of the drug by again administering it. It must, however, be noted that in some of the cases such as my first one, that a certain chronic anæmia is produced and does not immediately disappear when the drug is discontinued.

Basic Granulation of the Erythrocytes. Williams B. Cadwalader,[6] of Philadelphia, in studies on the basophilic granulations of the erythro-

[1] American Medicine, 1903.
[2] New York State Journal of Medicine, September, 1905.
[3] Proceedings of the Philadelphia Co. Med. Soc., January 10, 1905.
[4] International Medicine, May 1, 1906.   [5] Loc. cit.
[6] American Journal of the Medical Sciences, February, 1905.

cytes in lead poisoning and other conditions, with special reference to the relation which they bear to the nuclei of the red blood corpuscles, called attention to several interesting facts. He found a seemingly close relation between the presence of the nucleated red cells and the basophilic granulated reds and also in studying three cases especially, that there was a rise in the granular cells when the number of nucleated red cells began to fall, which fact seemed to strongly favor Schmidt's theory that the basic granulations were derived from the nuclei of the red cells and that the presence of the nucleated red corpuscles in the circulating blood is due to some toxic influence, such as lead, upon the hæmopoietic organs.

This, of course, opposes the view supported by Grawitz, White, Pepper, Simon and myself, which accounts for the presence of the granules as a degeneration of the protoplasm of the red cells, by the same toxin, perhaps, which causes the expulsion of the nucleated red blood cells from the blood-forming organs.

Cadwalader used Unna's polychrome methylene blue, as prepared by Grubler, and grouped the granules which be found under three types:

In type 1, he placed fine and coarse thread-like strands; in type 2, fine dot-like granulations; and in type 3, a dense coarse mass.

These he believed represented stages in the change from nucleated to non-nucleated red corpuscles, in the inverse order from that in which they are given.

The polychrome methylene blue stain has given some erroneous and misleading results, especially noted by one or two German workers, and possibly some of the clumps and masses, not distinctly dot-granules were due to deposits and artefacts caused by or coming from this stain.

In counts made from eleven lead workers without subjective symptoms and in sixteen cases of lead poisoning, Cadwalader found the degree of anæmia was always very slight, the lowest estimation of the hemoglobin being 65 per cent. in one case, with a much higher average, while the number of red blood corpuscles usually averaged over 4,000,000 per c.mm., although in three instances they fall just below 3,000,000 per c.mm.

The following conclusions were drawn:

1. Basophilic granules occurring in erythrocytes are normally present in small numbers in the blood of man, but may be increased in numbers under certain pathological conditions and decrease as convalescence is established.

2. Nucleated red corpuscles are common in the blood of those suffering from lead poisoning, and are always accompanied by an increase in the number of granular red cells.

3. The anæmia secondary to lead poisoning, as a rule, is only of a moderate degree.

4. The granular cells are most common in lead poisoning, possibly have their origin in the blood-forming tissues, and are probably the results of a fragmentation of the nucleus of the red blood corpuscles.

It is by no means certain that the granular cells observed in Cadwalader's method of study correspond to those obtained by the dry methods used in earlier investigations.

Blood Platelets. J. H. Pratt,[1] in a critical study of the various methods employed for enumerating blood platelets, rather opposes the use of the counting pipette described in PROGRESSIVE MEDICINE, June, 1905; because the two chief characteristics of the blood platelets are their marked tendency to undergo speedy dissolution in shed blood and their property of adhering to one another and to foreign objects, which constitute the causes for the difficulty in counting their number accurately.

Halle,[2] 1883, concluded that it was impossible to determine the absolute number and saw that it would be best to estimate the relative number in fresh preparations.

Türk[3] employed the same method, believing the newer methods untrustworthy. Eberth and Schimmelbusch, of Stuttgart, in 1888, also believed there were more platelets in the circulating blood than the counts indicated.

Hayem,[4] 1889, recommended the amniotic fluid from a cow to which the tincture of iodine had been added. This was prepared according to a method devised by Max Schultze in 1864. Hayem, citing his pupil (Cadet, in 1881), states that from one hundred and eight healthy individuals examined, the count averaged about 250,000 platelets per c.mm.

Afanassief,[5] 1884, found that a weak peptone solution preserved the erythrocytes as well as the platelets and upon the addition of an aniline dye, such as methyl violet, allowed the staining of the platelets.

Fusari, of Torino, Italy, in 1886, used the mélangeur and later Muir, 1891, used a graduated pipette, especially recommending rapidity in the method. Kemp and about the same time Laker found that some of the platelets always adhered to the walls of the pipette and so counts were too low. Later Brodie and Russell, Determan and Pratt employed the indirect method of first determining the ratio of platelets to the red blood corpuscles in a drop of diluted blood, and the number of red blood corpuscles being known, the number of platelets was easily calculated.

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[1] Journal of the American Medical Association, December 30, 1905.

[2] Zeitschrift f. Heilkunde, 1883, vol. iv. p. 331.

[3] Klinisch. Untersuchungen über das Verhalten des Bluts bei acuten Infection Krankheiten, Wien, 1898, p. 6.

[4] Du Sang, Paris, 1889, p. 14.

[5] Deutsch. Archiv f. klin. Med., 1884, vol. xxxv. p. 317.

Brus, in 1886, found a count of 500,000 per c.mm. in healthy individuals, using a modification of Fleming's solution, dissolving out the erythrocytes and thus preventing the obscuring of the platelets by these.

Von Emden in 1898 used the same method and cooled the pipette in a freezing mixture, as Hayem had shown this prevented so rapid destruction of the platelets but found only half as large a count as Brus.

Brodie and Russell, using a solution of glycerin dahlia and 2 per cent. sodium chloride, found that the platelets were still freely movable but must be quickly examined as the hemoglobin was soon dissolved out of the erythrocytes. They found 635,000 platelets with 5,400,000 red blood corpuscles.

Determan, using a variety of fluids, found in twenty-five healthy individuals an average ratio between the red blood corpuscles and the platelets of twenty-two to one, and in 5,000,000 red blood corpuscles, an average of 227,000 platelets.

Kemp and Calhoun in two series and later Kemp alone found 862,000 per c.mm. for men and 833,000 for women, and later only 457,000 per c.mm.

Pratt sums up his criticism of previous methods upon four sources of error:

1. Fragments of erythrocytes (Arnold's bodies) have been mistaken for blood platelets and so make the count too high.

2. The use of the graduated pipette, owing to the sticking of many platelets to the sides, makes the count too low.

3. The use of the ordinary counting chamber, because the depth is fifty times the diameter, causes many platelets to be missed by the oil immersion objective, which, however, is necessary to distinguish red blood corpuscles from platelets. Helber's chamber is, of course, a great improvement on this.

4. The lack of satisfactory preserving fluids, as with the present means the platelets either stick together or do not remain freely movable.

Pratt's method by comparative count, which many workers in the study of blood platelets favor, consists in the following: a solution of sodium metaphosphate, gm. 2.0; sodium chloride, gm. 0.9; distilled water, 100 c.cm. was used following suggestions from Krehl and Deetjen. A drop of blood obtained without pressure from the ear was conveyed by means of the ordinary platinum loop to a slide and diluted with three or more times as much of the preserving fluid and, without delay, covered by a coverglass. The spread must be so thin that the erythrocytes are well separated. Stirring is not necessary. Examination should be with the oil immersion lens. A square diaphragm made from paper

and attached to the ocular, aids in the count. For accuracy, two counts should be found to be alike. When 250 to 500 red blood corpuscles have been counted, the ratio is calculated.

Comparative counts by different methods showed that Helber's method gave 330,000, while Pratt's method gave 550,000 from a healthy man aged twenty-five years, whose red blood corpuscles showed 5,552,000. Pratt believes that his count shows more nearly the true number of platelets existing in the blood.

Kornel, Preisich, and Paul Hayem[1], in a paper concerning the origin of blood platelets, said that our knowledge of the third element of the blood—the blood platelets—is the fruit of the work of hæmatologists for the past thirty years. Wirk, Hayem, and Bizzozero said that the blood platelets were a pre-existing element of the circulating blood and many authors have since agreed with this, notably Laker.

Lillienfeld demonstrated that the blood platelets contained nuclein, as did the nucleii of the leukocytes, and thought that they were derived from these.

Hayem believed they came from the red blood corpuscles and Wlassow and Maximow, after treating the blood with a sublimate solution and shaking well, found small buds on the red cells, which later separated and these they believed were the blood platelets.

Engel believed all red cells once to be nucleated and some have believed that the disappearance of the nucleus accounted for the basophilic granulations and others that the platelets were the result. Arnold, and later Schneider, thought that the platelets came from the red blood corpuscles but that a small part came from the leukocytes. Thus a short resumé of the foregoing shows that some authors take the platelets to be self-existing cells; others that they are cell derivatives. Of these some say that they come from the leukocytes; others that they are from erythrocytes, and, of these, some think that they come from the nuclei of the reds; and yet others believe that they are not in the living blood but consider them artefacts from some outside influence.

Preisich and Hayem used a modification of Romanowsky's stain, taking ten drops of a solution of methylene blue filtered with 10 c.c. of distilled water, adding two drops of solution of eosin and quickly mixing and allowing the blood preparation to float on the surface. This stained the red blood corpuscles steel-blue, the cell nuclei violet, the protoplasm of the lymphocytes blue, the granulations of the white cells red, while the granulations of the eosinophiles did not stain but the protoplasm of these cells had a light blue appearance. The blood platelets were a reddish violet to a bright red and the same color as the granulations of the white blood cells. The nuclei of diseased white cells were bright

[1] Virchow's Archiv, Bd. clxxviii. No. 1.

red, although showing every shade up to light pink. Experimenting on children and animals, they found no difference in but a great variation in the distribution of the platelets and that they were either round or oval. The red cells contained platelets, sometimes as many as three or four, differing from the genuine nucleated reds in that the nuclei have a different structure and shade. Sometimes the platelets were partly outside of and partly within the cells. They drew the following conclusions:

1. That the blood platelets are present only in the blood of mammals; that is—in the blood of those animals which contain red blood corpuscles without nuclei, while, in the blood of those animals which have only nucleated reds, blood platelets are not present.

2. That the platelets arise from nuclein material or at least contain that material in large amount.

3. That they show affinity toward the nuclear staining material, wherein its behavior is identical with the normal cell nuclei, in so far as the latter take a dry stain with the usual staining methods, while the blood platelets stain only faintly.

4. On the inside of the red blood corpuscles blood platelets are often found placed like the nuclei.

5. The non-nucleated red blood corpuscles of mammals are derived from nucleated red blood corpuscles.

The staining of the cell nuclei of red blood corpuscles and the blood platelets show about the same difference as is seen between living and dead bacteria, which points to a degenerative process.

Experimenting further to prove that degeneration took place and using guinea-pigs and rabbits as well as children, the following conclusions were reached:

The blood platelets are not a third separate cell-element of the blood but are evidently the degenerated and thrown-out nuclei of the original nucleated red blood corpuscle. The nucleated red blood corpuscle remains under normal conditions in its place of origin until its nucleus begins to wander toward the periphery; that is, until the red blood cell is mature. The red blood corpuscle then goes into the blood stream and throws off its nucleus, now degenerated, which is known as the blood platelet in the circulation.

Hans Herschfeld,[1] of Berlin, in his remarks on the work of Preisich and Hayem called attention to the fact that they were not the first to hold the view that the platelets are derived from (the nuclei of) the red corpuscles, mentioning the work of Vremer in 1894, Arnold and others and his own. His conclusions in his former article were:

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[1] Virchow's Archiv, Bd. clxvi. Heft 2.

1. That the blood platelets arose doubtless from the red blood corpuscles.

2. Always only a limited number provide material for the formation of the platelets.

3. These platelets arise inside certain erythrocytes, where they lie as endoglobular plates, eventually in greater numbers in the middle of the cell.

4. These endoglobular plates leave at one place, and rarely at two or more places, and become free platelets.

5. The origin of bodies similar to blood plates occur from leukocytes but rarely in normal blood, and more often in leukæmia.

DIABETES.

Etiology. In discussing the "Nature of Diabetes," Bosanquet[1] in the Goulstonian lecture sums up as follows:

1. Excess of sugar in the blood, which is the condition precedent of glycosuria, may be caused by overproduction of sugar in the system or by diminished use or excretion. There is practically no evidence of either of these last processes. There is convincing evidence that at one stage, at all events, of diabetes there is increased production.

2. Overproduction of sugar may depend on some digestive irregularity whereby more sugar than normal is poured into the blood from the food, or of manufacture of sugar from the tissues of the body. We have sufficient evidence that both these processes are at work in diabetes, in that, at first, the output in the urine can be controlled by limiting the diet, whereas later this is not possible. But, whereas there is a considerable number of conditions in which sugar appears in the urine apparently as a result of absorption of additional sugar from the alimentary canal— these conditions being identical with diabetes only in the single fact of the appearance of sugar in the urine, while they run an entirely different clinical course—it is in diabetes alone that we have at any time evidence of formation of sugar from the tissue cells of the patient. This autolytic formation of sugar, if it may so be called, is the characteristic feature of diabetes in so far as the production of sugar is concerned.

3. It involves less of an assumption to suppose that this autolytic formation of sugar is present in diabetes all through the disease than to suppose that it ensues after a time as a result of the presence in the blood of an excess of the very substance-sugar—into which the cells finally break down. The absence of proof of the existence of this process in the early stages of the disease, when the glycosuria is controlled by diet,

[1] Lancet, April 22, 1905.

may be due to the body possessing a certain power of utilizing sugar in its nutritive processes so that only the excess above a definite quantity appears in the urine.

4. There is sufficient evidence available to establish beyond the possibility of doubt the fact that there is some connection between the pancreas and diabetes. Although it is not yet proved, yet it is becoming increasingly probable that the pancreas is diseased in all cases of diabetes mellitus. An increasing bulk of evidence is also accumulating to show that the function of the pancreas, which is in abeyance in diabetes, is normally performed by certain special groups of cells known as the islands of Langerhans, which are distinct from the ordinary secreting cells of the gland, but which are not improbably formed from the acini. The special lesion of these islands—hyaline degeneration—which has been associated with diabetes by some writers is not present in all cases of the disease and may be found (in a less developed state) in other conditions.

5. The action of the pancreas may be exerted in the direction either of supplying a substance necessary for the assimilation of sugar by the cells of the body, or in that of counteracting a poison which in some way causes accumulation of sugar in the blood. There is little or no evidence in favor of the former possibility; in favor of the latter there are the results of experimental intoxication with phloridzin, with suprarenal extract and with other substances and a few inconclusive results obtained by injection of secretions derived from diabetic patients.

6. We are not yet in a position to state with any certainty what tissue in the body gives rise to the sugar formed in diabetes. The theoretical possibility that sugar may be derived from fat is supported by certain observations which prove that a serious disturbance of the adipose tissue exists in diabetes. Further, if this hypothesis be admissible a certain unity will be introduced into our conception of diabetes, the phenomena of which will be explicable as manifestations of a single process occurring in a single tissue.

7. Lastly, glycosuria as opposed to diabetes may be due to mere excess of sugar poured into the blood from the alimentary canal in excess of what the system is capable of assimilating, or it may be due to causes acting analogously to the diabetic puncture of Claude Bernard and leading to a discharge of sugar by the liver from its stores of glycogen.

If, continues Bosanquet, the views here set forth are correct, it follows that in its earliest stage the diabetic process may constitute rather a predisposing cause of glycosuria than the actual cause of the phenomenon, since breaking down of the tissue cells into sugar is at first not more than sufficient to saturate the sugar-assimilating powers of the system. At this stage a slight increase of saccharine food will produce glycosuria— an increase which in a normal person would not have this effect. Simi-

larly a slight nervous shock, sufficient to cause the liberation of only a comparatively small quantity of glycogen from the liver, would also augment the sugar present in the blood above the point at which it appears in the urine. In such a way the onset of true diabetes might be ascribed to a shock, when in reality it was previously existent, but unnoticed. As far as a definition is possible, then diabetes might be defined as an increased internal dissociation of tissue (possibly fat) into sugar, caused by a toxic substance which is produced in the course of normal metabolism and which is normally neutralized by the pancreas.

The exact etiological relationship of the *pancreas* to diabetes is by no means settled. In reviewing the work done in the past few years, we find that the anatomical changes described by various authors, including Opie, Weisselbaum, Stengel, R. Pearce and others, have varied greatly. In PROGRESSIVE MEDICINE, 1902, the subject was fully discussed up to that date and last year the findings of Pearce in six cases of diabetes were given in detail. In a series of cases coming to autopsy, the majority has shown anatomical changes in the pancreas and in certain of these cases, though by no means frequently, the islands of Langerhans have exhibited rather peculiar abnormalities. The latter were found lessened in number, atrophied, shrunken by connective tissue; the cellular elements had undergone oedematous degeneration, and the walls of the capillaries exhibited a hyaline degeneration. The acini of the gland were often relatively in normal condition. On the other hand others, notably von Hauseman and Herxheim, found that changes in the islands themselves were particularly infrequent, but that the changes in the parenchyma of the gland were fairly constant.

Labbe[1] calls attention to the probable *infectious origin of the disease*, reporting two cases developing symptoms of diabetes following acute infections in the nose and throat. He takes issue with Naunyn who believes glycosuria following an acute infection to be a coincidence and not a consequence and that the infection has brought to light a previously existing diabetic condition either by offering the opportunity for a urine examination or by increasing a glycosuria which has escaped previous notice. Labbe thinks that it is just as logical to consider a glycosuria as it is an albuminuria as consequent to an attack of scarlet fever, and contends that the classification of diabetes as pancreatic, nervous, hepatic, etc., is illogical and that it is due to a disturbance of the function of the sugar-regulating apparatus and not to a disease in any special organ in the group forming this apparatus.

Weber[2] reports three cases among sixty diabetics in which the husband first exhibited symptoms of diabetes after living a number of years with

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[1] Presse Medicale, No. 62.
[2] Medical Record, October 8, 1904.

a diabetic wife, and tends to direct the attention to this theory of the infectious origin of the disease.

The existence of *conjugal diabetes* is looked upon as being highly probable by A. Martinet[1]. He bases this belief upon his observations in Paris among eight hundred and fifty-eight cases suffering with various medical conditions. Twenty-five diabetics were found and in five instances both husband and wife were affected. The proportion of diabetics to disease in general was one to thirty-four while the relation of *conjugal diabetes* to diabetes was one to five. He compares his statistics with those of other authors as follows:

	Cases of diabetes.	Cases of conjugal diabetes.	Per cent.
1. Schmitz . . .	2,320	26	1.12
2. Deléage . . .	. 478	17	3.55
3. Debove . . .	. 50	6	12
4. Martinet . .	. 25	5	20

He calls attention to the fact that in order for such observations to have any special significance it is necessary to compare the proportion of conjugal diabetes to the total number of diabetes with the proportion of diabetes to those suffering from diseases in general. Such a comparison exists only in his statistics. The enormous differences in the percentages shown in the table above Martinet considers of easy explanation. Schmitz and Deléage made their observations at watering places (Neuenahr and Vichy) particularly frequented by diabetics. Debove and Martinet made their observations in Paris where diabetics were not particularly or artificially congregated. Therefore the conditions are not identical. The former only had their patients under observation for an average period of twenty-one days after which they completely lost sight of them, and were only able to discover synchronous and contemporaneous conjugal diabetes when husband and wife applied for treatment at the same time; the latter authors, however, made up their statistics from observations of diabetics extending over a greater period of time.

The etiological *relationship of trauma to diabetes* is looked upon with skepticism by Krausch,[2] but Seiffert[3] reports a case which apparently has direct connection with cerebral traumatism. A boy of sixteen fell down an elevator shaft, a distance of twelve feet, striking the floor head first. He was unconscious an hour and stupefied for seventy-two hours. Sugar was found in the urine twelve hours after the accident; also albumin and blood. Daily analyses over a period of eleven days revealed the presence of a glycosuria. Sixty days after the injury the patient re-

[1] Presse Medicale, December 7, 1904, No. 98.

[2] Zeitschrift f. klinische Medizin, 55.

[3] American Medicine, July 8, 1905

sumed light work which he continued for two years when he again sought medical advice because of increasing debility, emaciation, polyuria, and depression of spirits. At that time the daily output of urine was between seven and thirty pints and the sugar varied from a trace to 7 per cent. In spite of all therapeutic measures, the patient has grown steadily worse and is now twenty years old.

Navarre[1] has investigated the proportion of diabetics among the employees of one of the French railroads. The entire number of cases of diabetes reported by the medical officers of the road during the past ten years is 222, an average of 3 per 1000. The proportion is much higher among engineers and conductors than among other employees, being 12.63 per 1000 among the former and 13.1 per 1000 among the latter; while only 1.76 per 1000 among office employees. During the last four years, 723 employees have been retired on account of chronic illness, fourteen of these being diabetics. Of this number, eleven were engineers or stokers, while only three were from the office force. The author comments that these figures suggest that vibrations and jars evidently favor the development of diabetes.

Treatment. The literature during the past year on the treatment of diabetes has been rather voluminous and while nothing has been offered in the way of curative measures, the experience of clinicians has emphasized several important factors. The generally increasing belief in the predisposition of certain individuals, especially children of diabetic parents, to this disease has directed attention to prophylactic treatment. Stark[2] lays particular stress upon this and again advocates as he did several years ago the necessity of systematic examination of the urine of all persons over thirty-five years of age, even when they are apparently enjoying the best of health. The racial predisposition of Hebrews should be borne in mind and the predisposition by reason of prolonged mental strain or a sedentary life should not be lost sight of. He calls attention to the close relations between diabetes and certain other morbid states, such as gout, obesity, hepatic congestion, affections of the nervous system, and arteriosclerosis; and to the fact that the occurrence of an excess of uric acid may be the forerunner of a confirmed diabetism, while oxaluria due to overindulgence in carbohydrates and nitrogenous food has been found in some cases to be the premonitory stage of diabetes. The preventive to be employed must be chosen according to the needs of the individual patient. Rest and complete change of surroundings may be all that is necessary in those cases under mental strain. In obese subjects Stark recommends the enforcement of suitable exercise, general massage, and hydrotherapeutic measures. The state of all the functions

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[1] Semaine Med., April 19, 1905.
[2] Medical Record, September 23, 1905.

should be carefully watched, the skin, bowels, and kidneys regulated constantly. The diet should be regulated according to the same principles as when the disease is fully established. Naunyn[1] also calls attention to the congenital predisposition, frequently inherited, of individuals to diabetes and emphasizes the importance of watching for initial manifestations in individuals known to be predisposed. In every disturbance of health in a member of the family in which cases of diabetes have occurred the urine should be tested as a routine measure, especially in individuals inclined to be corpulent; children in particular, and above all, any individuals in whom a tendency to obesity develops suddenly. In such persons, even if there be no signs of diabetes, their physical and intellectual work should be supervised with great care and especially should overeating be forbidden, and milk, green vegetables, and fruits, excepting the very sweet ones, should be recommended in moderation.

SYMPTOMATIC TREATMENT. Stark recommends for the excessive thirst the sucking of small pieces of ice or drinking a mouthful of water at stated intervals in order to keep the parched mucous membrane of the mouth wet, taking small quantities of water acidulated with lemon-juice or a little bitartrate of potassium. If these fail, total abstinence from carbohydrates for two days in conjunction with increasing doses of codeine, beginning with one-third or one-fourth grain three times a day, increasing by one-third or one-fourth grain every third day until two grains are taken three times daily, the third dose being given to induce sleep.

Tyson[2] prefers gum opium to codeine, watching carefully its tendency to constipate. For the hollow feeling in the stomach due to the craving for food, Stark uses one grain asafetida pills. Enteroclysis has also been suggested as relief for the intense craving for water.

For the extreme emaciation accompanied by muscular weakness, Stark recommends the forced feeding of fats notwithstanding the objection raised by others that the acetone bodies found in diabetic urine are due to the excessive assimilation of fat. The quantity and quality of fats to be administered must be estimated according to the condition of the stomach or intestines. The drug armamentarium was fully discussed in last year's PROGRESSIVE MEDICINE and nothing new has been offered this year which has a beneficial effect upon glycosuria or polyuria.

Diet. When a case of diabetes is once established, diet and hygiene form the basis of treatment. The reports of the past year emphasize that beneficial results are obtained not by a mere restriction but by a regulation of the diet, determining the requirements of each patient and

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[1] Deutsche med. Wochenschrift, xxxi., No. 25.
[2] Therapeutic Gazette, December 15, 1905.

following no set rules. In order to accomplish this, both Tyson and Naunyn insist upon the most careful and persistent routine quantitative examination of the urine.

Stark[1] considers that a proper treatment of a case of diabetes requires a knowledge of the following items:

1. The power of assimilation for carbohydrates which is readily ascertainable by current methods.

2. The general state of the patient whether anæmic, plethoric, obese, or emaciated.

3. The mental attitude of the patient, whether depressed, hopeful, negligent or indifferent.

4. The patient's ability to maintain weight.

5. The state of digestive functions—the presence of atony, insufficiency, or otherwise impaired function.

6. His ability to maintain a nitrogenous equilibrium as indicated by a comparison between the specific gravity and total solids of the urine, and the amount of urea excreted on the one hand and the amount of proteid food ingested on the other hand.

7. The patient's age, physique, occupation, whether old or young, robust or frail, engaged at hard or easy labor, leading an active or sedentary life.

8. The presence of complications, particularly nephritis, myocarditis, or arteriosclerosis.

9. His natural preference for foods and beverages.

The special cures were fully discussed in PROGRESSIVE MEDICINE, 1904. Naunyn thinks the success of these is due to the fact that a large proportion of the substance ingested passes through the system unutilized. He considers the cure as practically being an underfeeding and that the apparent tolerance is merely that comparatively little of the diet is assimilated.

Friedenwald and Ruhräh[2] report their experiences with the "milk cure," "potato cure," and "oatmeal cure." They rarely found an exclusive milk diet advisable for their patients except in the most severe cases of diabetes in which diacetic acid was present and in which the patient was threatened with the onset of diabetic coma or in which this condition had already set in. They have, however, utilized a half to one meter of milk daily in many of the cases in addition to other foods and have obtained excellent results. They found, however, that it was important to observe the effect of this form of food lest it produced injury to the patient. With the potato cure, they never followed the Mosse plan strictly, that is by replacing all carbohydrates by potatoes, but they

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[1] Medical Record, September 23, 1905.
[2] American Journal of the Medical Sciences, October, 1905.

followed the method suggested by von Noorden by replacing a portion of the bread by this form of food. If the patient was permitted to consume 100 grams of bread daily, he could take 300 grams of potatoes, so that at least a certain proportion of the bread must be replaced by this form of food. They have never seen the slightest harmful effect produced by the use of potatoes even in the severe forms of diabetes if care was taken to regulate the proportions. In a number of the cases very beneficial results were obtained. The results with the oatmeal diet were satisfactory. It should never be utilized in mild forms of diabetes but only in the severe forms. In these cases they obtained remarkable results and it was possible to rid the urine of sugar, even when this could not be done on an entirely carbohydrate-free diet. In some of the cases the oatmeal diet not only caused a disappearance of the sugar in the urine but also the diacetic acid. They are undoubtedly valuable aids in the treatment of diabetes but great care is necessary and each case must be studied individually to obtain the best results.

Lidwell[1] has used rye bread with success, finding that it satisfies the craving and stops the empty feeling of which so many of the diabetics complain and that the patients eat but little of it in proportion to wheat bread, about a loaf and a half sufficing for a week. This bread contains but little digestible starch and is a laxative. The patients do not tire of it and it is cheap. The author obtained the best results in the milder forms of glycosuria occurring in the middle aged or old.

Both Naunyn and Tyson find that the occasional interposition of a "hunger" day is very useful, allowing nothing but tea and bouillon for twenty-four hours. The effect is sometimes remarkable, but does not exhibit itself until the sugar has been reduced to a minimum. It then not only causes the sugar to disappear but increases the limits of tolerance thereafter. Both of these authors insist upon a careful and persistent examination of the urine, not only for the presence of sugar but also for the presence of diacetic acid. If the latter reaction is positive acidosis exists and *sodium bicarbonate* should be administered in doses of 90 to 120 grains daily. If the action grows more and more pronounced, the alkaline treatment should be increased and the diet become more limited. Tyson has found that alkaline waters, such as Vichy or Carlsbad, are very helpful. He believes, however, that the improvement of patients at the different natural mineral springs depends as much upon the relaxation and freedom from care, in the regular diet, and the hygiene of the individual as from any specific action of the waters.

The treatment of coma was discussed last year and nothing new has been suggested in the recent literature.

[1] Intercolonial Medical Journal of Australasia, August, 1905.

GOUT.

Etiology. Nothing definite has been established in regard to the pathogenesis of gout, though numerous theories have been offered. The chief advance has been on therapeutic lines. A few contributions to the etiology, however, are worthy of notice.

Schmoll[1] reviews the formation of uric acid and emphasizes its derivation by oxidation from the purin bodies, obtained either from the food or from the cell nuclei in catabolism. After considering Garrod's classical arguments, he concludes that the deposit of uric acid from the serum into the joints of gouty patients is due to neither retention nor increased production. He says that if the uric acid production in a gouty patient be increased by injection of thymus gland in large amounts, the surplus of uric acid is eliminated by the kidneys without showing any difference from normal conditions though the excretion may attain to two grams in twenty-four hours. He argues from this that a retention cannot take place because the kidneys are able to take care of a much larger amount than is found in normal conditions; while an increased production, other things being equal, could have but one result, which is increased secretion. He then calls attention to the fact that at the same time that the uric acid is being formed by oxidation from the uric bases, thymic acid is also formed and that Kossel and Minkowski have shown uric acid forms a compound with thymic acid. This compound shows the peculiarity that the uric acid in it cannot be detected by our present tests for it and cannot be precipitated. He says there can be little doubt that in physiological conditions this compound is the form in which the uric acid circulates through the body and adds that the morbid feature of gout is not the presence of uric acid in the blood but its precipitability; and this accounts for the otherwise unexplained fact that we cannot find any uric acid in normal blood. Normal blood contains uric acid combined with thymic acid and hence undetectable and while gouty blood may contain an amount not exceeding the normal, it is precipitable and hence, he concludes, *not* combined with thymic acid.

Why is the uric acid uncombined? There may be two explanations— first that it is formed normally by oxidation of the purin bodies but for some reason not combined with thymic acid, and second, that it is formed synthetically and not by oxidation; which he concludes is certainly possible. By feeding gouty patients with paranucleins and thymic acid he concludes that in gout the uric acid is formed by both of the above methods but that the synthesized uric acid has not at its disposal the thymic acid necessary for its solution. This accounts for its detecta-

[1] Journal of the American Medical Association, April 29, 1905, p. 1348.

bility in the serum. He uses the above theories in treating gout and gives 0.25 gram thymic acid three to four times a day with beneficial result. When the uric acid is formed in excess, with a deficiency of thymic acid, deposition in the joints or tophi takes place, but on feeding thymic acid the uric acid when formed combines with it and is easily eliminated.

Almagia[1] has studied the absorption power of cartilage for uric acid and made solutions as nearly neutral as possible of sodium urate, placed in them thin slices of joint cartilage and after a time determined regularly the remaining quantity of uric acid. He found regularly a reduction of the sodium urate in solution. Macroscopically there were white spots and cloudy areas in the cartilage resembling those seen in gout which could not be washed off or removed by scraping the surface. Microscopically they consisted of crystalline masses. What urate was present could not be determined but it was certainly a urate because after thorough washing with cold water, hot water extracts gave a murexide test. Hence cartilage can absorb sodium urate from very dilute solutions and cause it to deposit in crystalline form, the process being similar to the known absorption of crystalloid and colloid substances by the crystallizing out of colloids; this is important in that it permits the absorption of furthur material and also tends to cause mechanical damage to the cartilage tissues. In the above experiments, low temperature reduced the absorption or delayed it, which is of interest because the feet, hands and ears are most exposed to cold and the cartilages have poor blood supply.

Almagia also experimented with tendons and with the cartilages of the nasal septum and larynx. These absorbed about the same amount of urate, though it did not crystallize out, and it could be extracted by hot but not by cold water. The percentage amount of urate in the cartilage became after a few days eight to fifty times as much as that in the solution. The possibility that some chemical union with the tissues or chemical changes in the urate occurred was not settled. The irregularity of crystallization was perhaps due to chance factors but Almagia thinks the effect of mechanical shock should be studied. He says this demonstrates the absorption of urates by cartilage and that the inability of the cartilage to destroy urates (contrary to most other tissues) is normal and not peculiar to gout. Injection of urates into the peritoneal cavity of rabbits and subsequent examination of the tissues showed the murexide test almost always in the cartilages but not in the tissues. Almagia decides that on account of temporary or permanent increased urate content of the tissue fluids in gout, this deposition occurs; and owing to the fact that osmotic movement of the fluids takes place with difficulty in cartilages, and owing also to their apparent lack of power to

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[1] Hofmeister's Beiträge, December, 1905, Band vii., Nrn. 10 und 11.

destroy urates, the urates can at best disappear from the cartilages but slowly. Possibly the urates are absorbed in solution and then the over-saturated solution deposits crystals, owing to the mechanical shock, reduction of temperature or the production of acid salts, and this deposition produces necrosis and inflammation.

Shearer[1] believes that the unnatural excess of carbonic acid in the blood is the most potent factor in bringing about those changes which go to make up the gouty state.

Trautner[2] has been devoting much research to the relations between the *colon bacillus and gout*. He describes the technique of numerous tests which have conclusively demonstrated, he thinks, that the proportion of uric acid in the urine of a person subject to gout increases during times of partial or decided constipation. He believes that, under the influence of imperfect evacuations of the bowels, a reducing substance is generated by the activity of the ordinary colon bacillus. This reducing substance acts on the residue of the food and probably has some close connection with the uric acid of the urine. It is more than probable, he affirms, that the substance found in the colon by the bacteria becomes transformed into xanthein and into uric acid during the passage into the blood. He regards it as probable that the first manifestation of gout is a mucous colitis, and that the bacterium coli commune is the initial agent of gouty affections. Copious diuresis accompanied by high density should suggest, he says, an abnormally large proportion of uric acid.

Watson[3] concludes that the laboratory evidence is in harmony with clinical experience that uric acid in not an important factor in production of gout. He believes it to be partly at least infective and that the uric acid is the specific feature of the inflammation; giving it its character. The chief source of the infection is the alimentary tract and an injudicious diet acts chiefly by its influence on the bacteria of the digestive tract. This view by no means minimizes the importance of the hereditary factor and is somewhat in accord with Trautner's views.

Kionka, working with Frey,[4] finds degenerative processes in the livers and kidneys of mice fed exclusively upon meat, and notices the total absence of the glycocoll-destroying, urea-forming ferment in the liver of gouty subjects. He holds that pathological disturbances of the liver are not essential to gout but that functional disturbances are, and may lead to disturbance of the urea formation. The absence of the glycocoll-destroying and urea forming ferment in the liver may be congenital or acquired by improper living, and the successful therapy of gout depends

[1] Lancet, February 11, 1905.
[2] Nordisches Medicinisches Archiv., Stockholm, Internal Medicine, No. 1, 1905.
[3] British Medical Journal, January 21, 1905.
  Deutsch. med. Woch., xxxi. No. 29, July 20, 1905.

in part on hepatic stimulation by such cholagogues as benzoic and salicylic acids, colchicin, etc., while the purgatives may act helpfully. The above acids and quinic acid act also by binding the glycocoll and preventing its precipitating action on the uric acid in the organism. In the presence of a large amount of urea, glycocoll precipitates urates and when there is a gouty tendency, that is a lack of glycocoll-destroying ferment, an acute attack is determined.

Von Noorden and Schleif[1] discuss the *dietetic management of gout* based on separate studies of each individual case. They emphasize the facts that since it has been possible to differentiate between the endogenous and exogenous uric acid, *i. e.*, the uric acid formed from substances taken in as food and that formed by cell break-down in the body, it is known (1) that the uric acid production is minimized if nourishment is given containing no purin substances; and (2) that in gouty patients considerable retention of uric acid occurs. On a purin containing diet, the gouty patient metabolizes much more incompletely and more slowly than does a healthy man, and the uric acid elimination decreases and finally fails to reach the normal quantity. Von Noorden and Schleif think it probable that the insufficient increase of uric acid in the urine, following the ingestion by the gouty of uric acid-forming materials, depends not on a diminished formation, but on a retention, due to the peculiar pathological combinations of the uric acid in the gouty organism. They found by experiment that if a chronically gouty subject be placed on a diet free from *exogenous* uric acid-forming-substances, and if the *endogenous* uric acid be completely eliminated by the patient, an attack of gout follows in a few days if a large amount of uric acid-forming material be added to the diet.

The coincident examination of the urine shows that an increase of uric acid, to be expected from the increased diet, does not take place. This led the authors to undertake the "toleranz bestimmungen" as a basis for individual treatment and they started in six cases with a *purin free diet* and determined the uric acid output. On two consecutive days following the above, 400 grams of beef, weighed raw, were given, containing an average of 0.24 gram of purin nitrogen, 50 per cent. of which they believed disappears in the organism by oxidation and deficient resorption; and 50 per cent. appears in the urine as uric acid or purin bases. In all there should be 0.24 gram of purin nitrogen (equal 0.72 gram uric acid) eliminated from the two days' ingestion of meat, above and beyond the amount of endogenous uric acid excreted. This elimination occurs under normal conditions *on the two meat days* but without being regarded as pathological can be extended to the first or even the

[1] Berliner klinische Wochenschrift, xlii., No. 41.

second purin free day. In a gouty subject, however, the uric acid elimination is rarely normal. Generally it falls on the two meat days to a point much lower than normal, the elimination continues for a long time and the total amount remains less than a healthy person excretes in two to three days. The authors thus determine whether the gouty subject can take care of the purin bodies contained in 400 grams meat. If he can there is no objection to giving that amount, but if not, the ingestion of purin bodies must be diminished to guard against uric acid retention and gouty sequelae. Frequently smaller amounts of uric acid-forming nourishment could be utilized when the larger amounts could not and so important is this that the uric acid output of 200 grams of meat was actually larger than that of 400 grams of meat, where the tolerance of the organism was overstepped. As an example of this the following case is cited: A man fifty-five years; no severe attack of gout for some years, but many milder ones recently of one to two days' duration; numerous tophi on ears.

4	days	purin-free	diet	....	0.462	grams uric acid (average)			
5	"	"	"	"	+ 400 grams meat..	0.522	"	"	"	"
6	"	"	"	"	+ 400 " " ..	0.544	"	"	"	"
7	"	"	"	"	....	0.539	"	"	"	"
8	"	"	"	"	....	0.528	"	"	"	"
9	"	"	"	"	....	0.458	"	"	"	"
10	"	"	"	"	+200 grams meat..	0.549	"	"	"	"
11	"	"	"	"	+200 " " ..	0.655	"	"	"	"
12	"	"	"	"	....	0.647	"	"	"	"
13	"	"	"	"	....	0.499	"	"	"	"
14	"	"	"	"	....	0.433	"	"	"	"

The authors, therefore, think it important in every case of gout to study the tolerance of the individual for purin bodies just as is done with diabetics for carbohydrates. This toleration changes in the course of the disease but with proper observation a diet may be prescribed on a basis of the uric acid balance with which Von Noorden and Schleif have had more satisfaction than with any previous dietetic or medicinal measures.

More recently I. Walker Hall[1] has reached independently approximately the same conclusions and advocates a similar study of each case to determine the personal question of diet as the best means of therapy.

HÆMOPHILIA.

Etiology of Hæmophilia. De Bovis,[2] in reviewing the literature on *hæmophilia in women*, states that pregnancy is rather favorable than

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[1] British Medical Journal, January 20, 1906.

[2] Semaine Medicale, xxxvi., No. 35., cited from Journal of the American Medical Association, 1905.

otherwise; the blood apparently becoming less persistently fluid. In one hundred and fifty cases of deliveries in hæmophilic women, excessive hemorrhage occurred immediately afterward in sixty-nine. In two cases the mothers were unable to nurse their children as it seemed to increase the tendency to hemorrhage. Abortions are noted in the history of some hæmophilics. It is possible that hæmophilia may exist in a rudimentary form. In a case under de Bovis' observation, a multipara suffered from uterine hemorrhages during the fifth pregnancy. Artificial evacuation of the uterus was suggested but the curetting was followed by uncontrollable fatal hemorrhage. The patient was not a hæmophilic in the strict sense of the word, but nothing except a hæmophilic diathesis can explain the uncontrollable hemorrhage in this case. He cites de Lee's fatal case of hæmophilic diathesis, with premature detachment of the placenta although the uterus was firmly contracted. He calls attention to similar cases reported by Ahlfäld and Switalski all distinguished by postpartum hemorrhage occurring in women whose menses were always copious, with a history of abortions, or hemorrhage reaction in themselves or some relative. In de Bovis' service during 1903, there were 476 deliveries. The women had a record of menstruating for more than five days in 153 cases, and no less than five days in 323. Postpartum hemorrhage occurred in fourteen per cent. of the former and in only eight per cent. of the latter. He believes that the hæmophilic tendency may also manifest itself at puberty and at the menopause, remaining latent at other times. Hæmophilia is in de Bovis' opinion a condition which occurs much more frequently than is generally supposed, and women are affected as often if not oftener than men, but the tendency does not reveal itself in women except at times of physiological stress naturally tending to hemorrhage. At other times it may be that menstruation acts as a kind of safety valve. De Bovis thinks that marriage should be forbidden in families of bleeders, both of men and women.

Lossen[1] reports for the second time the hæmophilic family Mampel. The first report of this family was made by von Chelius in 1827; the second by Mutzenbecher in 1841; the third by Lossen in 1876. The present report carries the family up to the fourth generation. In the first generation there were eleven members, six males and five females. There were forty in the second generation, twenty-two males and eighteen females. Seventy-four in the third, forty males, thirty females and four stillborn. Eighty-seven in the fourth generation, forty-three males, forty-three females and one stillborn, making a total of 212 members in the family, 111 being males, ninte-six females and five stillborn. Of this number there were thirty-seven bleeders, all males, making a proportion of 33.33 per cent.

[1] Deutsch. Zeit. f. Chirurgie, January, 1905.

The location of the bleeding has been very carefully studied. Sixteen times it was subcutaneous caused by a fall, blow, pressure, or by such a slight injury as the rubbing of the trousers. In one case the mother asserted that the hemorrhages came of themselves and chiefly during the night. This was probably due to some slight injury caused by the child throwing itself about in bed. The resultant hæmatomata were as a rule absorbed. In one case only was it necessary to incise. Healing took place under compression. In two cases the bleeding under the skin was so severe that death resulted from anæmia. In ten cases, wounds of the skin, punctured, incised, and lacerated, slight in character, were the cause of the hemorrhages. In two of these, the bleeding was so severe that death resulted. Two cases of hemorrhage of the umbilical cord in the newborn may be classified under this heading. Hemorrhage from the mucous membrane of the nose occurred in ten cases. These occurred repeatedly and were very difficult to control. The primary cause was probably traumatism, such as scratching of the finger nail or violent blowing of the nose. From the lips, hemorrhage occurred in nine cases, mostly from the frenum of the upper lip, caused by falls or by injuries induced by the careless use of the knife or fork. The bleeding was always difficult to control and in five cases ended fatally. Similar causes, such as a fall striking on the mouth, injury by instruments produced hemorrhages of the gums in nine cases, two of which were fatal. In four cases injury to the hard palate produced hemorrhage, two ending fatally. The tongue was injured in two cases with resulting hemorrhage severe and difficult to control. Hemorrhage from the mucous membrane of the stomach occurred in two cases, one resulting fatally. Rectal bleeding occurred once probably as the result of the passage of hard fecal masses. Hæmaturia was noticed in three cases. In two of these the source was in the mucous membrane of the bladder. Trauma could not be determined in these cases. In one case the bleeding was so severe that the urethra became plugged with a clot which had to be removed by a catheter. In the third case the bleeding was renal, probably spontaneous. Pulmonary hemorrhage occurred in four cases. Two of these followed severe bodily exercise. A third which was fatal occurred without apparent cause. A fourth accompanied a pneumonia and ended fatally. Cerebral hemorrhage following a fall upon the back of the head occurred in one case and was fatal. Joint swellings were present in nine cases. Six of these affected the knee and one the elbow-joint. These cases as a rule improve rapidly, the blood being quickly absorbed under the influence of massage and hot moist applications. After repeated hemorrhage into the joint, there remained a slight serous infusion and moderate amount of stiffness. In five cases the stiffness increased with age which was probably due to a progressive adhesive

synovitis. Tumor albus or joint tuberculosis was not observed in a single case. The author admits the possibility of such a joint becoming the seat of tuberculous infection.

In recapitulation, there were 111 male members of the family, and of these thirty-seven were bleeders or 33.33 per cent. Of the thirty-seven bleeders, eighteen or 48.65 per cent., almost one-half, died of hemorrhage. Two from subcutaneous tissue and muscle, three from wounds of the skin, five from wounds of the lips, two from wounds of the gums, two from wounds of the hard palate, one from gastric, one from cerebral, two from pulmonary, and one from the umbilical cord hemorrhages. Most of the deaths from hemorrhage occurred during childhood. Seven occurred before the third year, six between three and ten years, one in the second decade, two in the third, and two in the fourth. After the fourth decade the tendency to bleeding disappeared. A careful study of the family tree shows that none of the females were bleeders and that the disease was only transmitted through them. Male members only were bleeders and these did not transmit the tendency to their offsprings if they married wives from non-hæmophilic families. This same rule was followed in the three families reported by Sahli[1].

In the Mampel family the mothers of nineteen of the thirty-one branches were sisters of bleeders and invariably transmitted the tendency. In these nineteen families there were eighty-two male members, thirty-seven of whom were bleeders or 45.14 per cent. This proportion varied in different generations. In the first, 50 per cent., in the second 68.42 per cent.; in the third 41.38 per cent.; and in the fourth 32.14 per cent. The tendency to bleed was the greatest in the second generation and began to diminish with the third. Sahli doubts that this indicates a gradual disappearance of the tendency, for the increase in the number of bleeders in the second generation over the first indicates the contrary. He believes it to depend on various conditions, first the proportion of boys to girls in the generation. In the third it was twenty-nine to twenty-five, in the fourth twenty-eight to twenty-six, and in the second nineteen to thirteen. Secondly, the number of marriages contracted by the female members. Third, the number of children in each generation. In the second there were thirty-two in two families; in the third fifty-eight, four being stillborn, in seven families. In the fourth fifty-five, one being stillborn, in nine families. The fertility in the bleeding families is noteworthy. In the nineteen families four had nineteen children, two had thirteen, two had eleven, and several had ten, nine and eight. On the other hand in the twelve non-bleeding families, only two had as many as eight. Three had seven, one had six, and the others

[1] Zeitschrift f. klin. Med., No. 56, 1905.

had from one to three children. The mortality during the first year of life aside from the deaths due to bleeding was fifty-seven. Forty-two deaths occurred in the first half of the first year, thirty being males and twelve females, and fifteen occurred during the last six months. Of these, five were males and ten females. In the nineteen bleeding families, the mortality during the first six months was 17.31 per cent., and during the latter six months 7.01 per cent., while in the twelve non-bleeding families the mortality was 26.76 per cent. and 7.14 per cent. respectively. Sahli, however, does not consider this relation to indicate anything of importance other than that the mortality in this family was by no means abnormal.

Lossen lays particular stress upon the importance of heredity in making a diagnosis of hæmophilia, and considers W. Koch's statement that scurvy, purpura hemorrhagica, and hæmophilia are one and the same disease, as showing a woful ignorance of the latter condition.

The etiology of this condition still remains puzzling. Undoubtedly many of the theories advanced during the past were based on an improper conception of the disease, many cases of scurvy being reported as hæmophilia. Sahli[1] has had the opportunity of studying four cases, the family tree of three being carefully recorded. These cases conjointly presented the typical picture of hæmophilia, that is severe hemorrhages following external injuries, spontaneous hemorrhage from the mucous membranes, acute joint affections which leave behind chronic changes, subcutaneous hemorrhages and renal hemorrhages. An examination of the heart showed an enlargement of the left ventricle in three cases and in one case there was also an enlargement to the right. In two of these Sahli believes that the enlargement could be explained by the presence of the high degree of anæmia, but in the other, there was no apparent cause for the hypertrophy. The time of the appearance of hemorrhage is interesting. In the first case it appeared in the second year; in the second case the history was uncertain, but it occurred early in life; in the third case it occurred in the eleventh month and in the fourth in the third or fourth year. In a case examined, the blood pressure was not increased either before or during the hemorrhage which tends to disprove the theory that the hæmophilic bleeding is partly due to a marked increase in the intravascular pressure. The morphological examination of the blood of members of three hæmophilic families showed a marked decrease in the percentage of neutrophile leukocytes with an increase in the percentage of lymphocytes. The leukocytic count was normal or less than normal, an indication, therefore, not only of a relative but of an absolute diminution in the number of polynuclear leukocytes.

[1] Loc cit

The blood platelets in the two cases in which they were estimated were below the average in number but within the limit found in many normal people. In the case in which the alkalinity of the blood, the dry residue of the serum and the lowering of the freezing point of the serum were estimated, normal results were obtained. In the one case examined, the fibrin content of the blood was normal.

The *coagulation of the blood* in the four cases examined by Sahli took place much more slowly than normal, especially so during the period in which the patients were not bleeding. This delay was so constant as to be of diagnostic value and was more easily recognized by estimating the time for the completion rather than the beginning of coagulation. The differences between normal and hæmophilic blood are most evident when the test is made with a large amount of blood. The failure to consider this particular, together with a disregard for the influence of external temperature and of the capacity of the capillary tubes used in Vierordt's method upon the time of coagulation, explain in Sahli's opinion the contradictory reports made by various authors. To eliminate these factors as sources of error, it is necessary in estimating the coagulation time of hæmophilic blood to make simultaneous tests with a capillary tube of the same calibre on the blood of healthy individuals as controls, since comparisons made with the so-called fixed normal point give false results; such a standard being impossible owing to the influence of external conditions upon coagulation. The blood also must be obtained from a fresh puncture and not from a wound which has been bleeding for some time and during the period when the patient is not suffering with the immediate consequences of hemorrhage. In one of the cases the blood was examined at the time of severe hemorrhage. The wound was covered with a well-formed clot but the blood ran briskly through it. This blood showed a marked acceleration in the coagulation which Sahli explains as being due to its being laden with the fibrin taken up from the clot as it filtered through it. At the same time, blood was taken from a fresh puncture. This also coagulated more quickly than the blood of a healthy individual.

Sahli explains this as being an evidence of a state of reaction on the part of the organism against the hemorrhage. During the non-bleeding period and after recovery from the evidence of this hemorrhage the blood of this same case again showed delayed coagulation. The continuation of hæmophilic bleeding despite the marked acceleration in the coagulability of the blood obtained from the bleeding wound indicates, according to Sahli, an abnormal quantity of the injured walls of the bloodvessels in that they supply an insufficient quantity of the substance which should act locally with the fibrin fermentation and thrombus formation in the lumen of the vessels. He believes that the natural cessation of

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bleeding depends on an active chemical property of the injured vessel walls as well as a physiological phenomenon of the general organism, and that in hæmophilics this activity is wanting or at least is reduced to a minimum. The substance which is supplied in an insufficient quantity in the hæmophilic in contrast to the normal individual is, according to his theory, probably either "thrombokinase" or a zymoplastic substance or a combination of both. He explains the deficient coagulability of the blood in the intervals between hæmophilic bleeding as a phenomenon of a faulty chemical activity of the vessel walls corresponding to that mentioned above, and, because of the analogous qualities of the cells and hematopoietic organisms, he believes this activity to be possessed by the cells of the vessel walls. He thinks that the deficient activity of the cells in the hæmophilic organism is *general* and inherited from the cell plasma. Retarded coagulation of the blood in his opinion does not explain the long duration of hæmophilic bleedings since this is merely a property of the extravascular blood, the cessation of hemorrhage depending upon the coagulation of the blood within the lumen of the vessels. Then, too, in Sahli's series of cases at the time of bleeding, the extravascular clotting was not only sufficient but was excessive. He believes that the chemical deficiency in the vessel walls of the hæmophilic also explaining the occurrence of spontaneous bleeding in this disease, if one assumes an associated abnormal fragility or, in case diapedesis is considered as a causal factor in bleeding, an abnormal permeability of the vessel walls. This theory explains the so-called local hæmophilias described by Senator and others in which the bleeding usually occurred in the kidney. If the properties attributed to the cells of the vessel walls and blood in hæmophilics be possessed by all the cells in the body, then Sahli believes that we have an explanation for the tendency to joint inflammations and their chronic course in this disease; especially so, since in certain cases these joint affections cannot be explained as a phenomenon of primary hemorrhage into the joint.

Bobroff[1] calls attention to the fact that the majority of hæmophilics are slight, with light hair, white and transparent skin, blue eyes and transparent teeth, although a few cases have been published of hæmophilia in the brunette and even in the negro. Kinnicutt[2] calls attention to the noticeably thin skin of delicate texture and ivory whiteness present in his case, a boy of sixteen years.

Treatment. According to the present knowledge of the constitutional anomalies of the hæmophilic, the indications for treatment of the disease in Sahli's opinion are confined to that of the general health of the patient. This is accomplished best by a well-regulated rational

[1] Medicinskoe Obezryenie, Moscow, 61, No. 1.
[2] Transactions of the Association of American Physicians, 1905.

nourishing diet. The preference for vegetables as a diet has no rational basis and arose from confusing hæmophilia with scurvy from which it is often very difficult to differentiate. For the control of hemorrhage, compresses of a two per cent. gelatin have proved very successful. A local application of adrenalin preceding the compression of gelatin does not seem to increase the efficacy of this treatment. Subcutaneous injections of gelatin while apparently not dangerous are useless. No benefit was derived from the external use of calcium chloride, and the internal and subcutaneous administration of ergotin and adrenalin he considers contraindicated. The local application of chloride of iron was found to be useless. The efficiency of local applications of calcium chloride or of the so-called zymoplastic substances or thrombokinase in the form of tissue juices or their extracts is from his experience with one of his cases very questionable. If they are to accomplish any good whatever, they must be forced into the lumen of the bloodvessels by firm compression. The use of thrombokinase and zymoplastic substances other than locally would be dangerous. Sahli does not consider the use of such artificial substances necessary but believes that much better results may be obtained by damming back into the lumen of the vessels the fibrin ferment thrombokinase and zymoplastic substances contained in the coagulum covering the bleeding wound by means of a thick and firm gelatin bandage.

Kinnicutt[1] is convinced of the efficiency of calcium chloride administered internally and believes the disappointing results often obtained in hæmophilics to be due to improper mode of employing the drug. It should be given in 30 grain doses two or three times daily; its continued use interrupted every two or three days by a period of twenty-four hours. He recommends local application of this salt in 0.5 per cent. solution. In order to supply the normal coagulating ferments of the blood, Weil[2] recommends the intravenous injection of human or beef serum in hæmophilia. In a typical case of hæmophilia with excessively protracted hemorrhages after slight traumatism, never spontaneous, intravenous injection of beef serum had a remarkable effect in inducing coagulation in the blood from the finger or elbow. Before the injection, blood from a vein in the elbow showed no signs of coagulation until after twenty-five to seventy-five minutes, but after an intravenous injection of 15 c.c. of beef serum, blood from the finger coagulated in three minutes and that from the elbow in from five to ten minutes. A week later 10 c.c. of the human blood was injected and by the fifth day coagulation was almost immediate. The interval between coagulation gradually lengthened until in two weeks it was from twenty to fifty-five minutes. Another intravenous

injection of 15 c.c. of beef serum reduced the interval again to less than eight minutes. This serum treatment or vaccination of the hæmophilic blood is only passive. The curative action of the injected serum becomes evident in forty-eight hours and continues marked for about a week, when it gradually subsides. Weil recommends it as a preventive measure in case an operation on a hæmophilic is necessary. In the case described, the patient had a tooth extracted after an intravenous injection of the serum and for the first time in his life the traumatism was not followed by excessive and prolonged hemorrhage. The gums did not bleed any more than was usually observed in normal individuals.

In his article on hæmophilia in women, de Bovis[1] ascribes the occasional success of general treatment to the fact that the patients are usually neuropathic. He believes that the main reliance is to be placed on very hot injections, swabbing with adrenalin and tamponing. Gelatinized dressings might also be used and Henkel's plan of compressing with forceps the uterine arteries at the base of the broad ligaments is suggested. Ablation of the bleeding organ should be the last resort. It has been de Bovis' experience that hæmophilics tolerate operation on the large arterial trunks better than superficial wounds which justify hysterectomy in case of menorrhagia or metrorrhagia.

HODGKIN'S DISEASE.

Etiology. During the year little has been written on the etiology of this disease further than to emphasize the fact that the tubercle bacillus is not a causal agent. Edsall[2] found no tubercle bacilli in the lesions of a case reported. Injection of pieces of glands into guinea-pigs gave negative results.

Warnecke[3] found no virulent tubercle bacilli in the lesions. He thinks the association of Hodgkin's disease and tuberculosis is only causal.

Shuman and Gaylord[4] report a case which had pulmonary tuberculosis as a final complication, but pieces of glands injected into guinea-pigs produced no evidence of tuberculosis, although the pigs died in about two months.

Pathology. Edsall[5] thinks Hodgkin's disease is a pathological entity. He found the characteristic lesions described by Reed, Longcope and others.

Warnecke[6] describes the pathological findings in four cases of pseudo-

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[1] Loc. cit.   [2] New York Medical Journal, October 21 and 28, 1905.
[3] Mitteilung aus den Grenzgebiet, Jena, xiv., No. 3.
[4] Archives of Pediatrics, July, 1905.   [5] Loc. cit.
[6] Mitteilung aus den Grenzgebiet, Jena, xiv., No. 3.

leukæmia and of a number of extirpated malignant lymphomata of the neck and axilla.

The microscopic findings were strikingly alike in all. No virulent tubercle bacilli were found in the lesions. The frequent association of pseudoleukæmia and tuberculosis is, he thinks, merely a coincidence.

The cases of Hodgkin's disease and the lymphomata all belong to the category of pseudoleukæmia. Warnecke in an examination of the literature of Hodgkin's disease enumerates as constant findings: the swelling of the entire lymphatic apparatus; the nodule formation in the lymphadenoid preformed tissue of the organs, especially of the spleen, giving it the appearance of "red porphyry;" the remarkable variability of the cells, all kinds mixed together with predominant epithelioid cells, fibroblasts and giant cells, some resembling bone-marrow giant cells.

Clinical Course. Edsall[1] describes a *milky pleural effusion* occurring in the course of Hodgkin's disease. The effusion was in the left chest and required aspiration twice; the last time 1500 c.cm. were withdrawn. The liquid had a milky appearance and filtration through an ordinary filter did not clear it and it was only when put through a Chamberland or Pasteur filter that it became clear. A sticky substance adhered to the filter and when dissolved in distilled water, proved to be only in suspension and settled to the bottom. The microscope showed these particles as very highly refractive globules but they did not stain with Sudan III or osmic acid. Tests for albumin were positive and the liquid did not respond to tests for fat. Edsall considers it of a proteid nature and probably globulin.

George Blumer[2] has reported a case presenting the clinical features of Hodgkin's disease. The patient was a young man, nineteen years old, with negative family and personal history. The disease began with progressive weakness, nausea, vomiting, and dyspnœa. Some fever in the evening with night sweats. In three months the patient lost thirty pounds in weight. A few days before death he had some pain in the liver. On examination he showed general enlargement of the lymph glands especially of those in the neck. There was also enlargement of the spleen and liver. The heart and the urine appeared to be normal. The blood showed 3,656,000 erythrocytes, 8000 leukocytes, and 54 per cent. hemoglobin. A differential count showed 8 per cent. of polymorphonuclears and 92 per cent. mononuclear forms, of which 45 per cent. were large cells and 47 per cent. were small ones. At autopsy the lymph glands, tonsils, spleen, and liver were enlarged. The lymph glands contained none of the large cells described by Reed as being characteristic of Hodgkin's disease and no eosinophiles. The lymph follicles of the

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[1] Loc cit.　　　[2] California Academy of Medicine, January 24, 1905.

spleen were especially enlarged. The kidneys were densely infiltrated with round cells and the bone-marrow showed a lymphoid hyperplasia microscopically. Clinically, the author considers the case one of Hodgkin's disease with the exception of the relative increase of mononuclear elements in the blood. Pathologically the case is one of lymphatic leukæmia as shown by the changes in the bone-marrow and other organs, a so-called "aleukæmic leukæmia."

Stoll[1] reports a case in which the following points are of interest:

1. The development of acute symptoms associated with an eruption nearly four years after the beginning of the disease.

2. The slight involvement of the superficial glands.

3. The occurrence of periodical abdominal distention and tenderness.

4. The alternating periods of pyrexia and apyrexia.

5. The unusually severe anæmia.

6. The disappearance of the glands before death.

Shuman and Gaylord[2] report a case of Hodgkin's disease in a girl of nine years, which was diagnosed as malignant lymphoma and the masses in the neck were twice removed. The patient finally developed pulmonary tuberculosis showing tubercle bacilli in the sputum three months before death.

Treatment. Stoll[3] speaks of the importance of the rest cure, the improvement of nutrition and an abundance of fresh air. Arsenic in the form of Fowler's solution should be given in large doses. The glands should be exposed to the Roentgen ray for a long period and the earlier such treatment is begun the better will be the results. Removal of the glands should be resorted to only when pressure symptoms are marked. The *x*-ray has been used widely in the treatment of Hodgkin's disease.

Holding and Warren[4] report from the literature twenty-two cases of pseudoleukæmia treated by *x*-rays and of these six were systematically cured, thirteen were improved, while in three cases the condition was either unimproved or the case terminated fatally.

Two cases were reported by Holding and Warren, who call attention to (1) the marked action which the *x*-rays have on the lymphatic system and blood-making organs; (2) its palliative action in cases of leukæmia and pseudoleukæmia and to suggest that in some cases a curative effect may be looked for; (3) further observations on the action of the *x*-rays in this class of diseases is recommended.

Schirmer[5] states that not one instance of failure of *x*-rays in pseudo-

[1] Medical Record, May 20, 1905.

[2] Archives of Pediatrics, January, 1905.

[3] Loc cit.

[4] New York Medical Journal, November 11, 1905.

[5] Centralblatt f. den Grenzgebiet, Jena, xliv. p. 747

leukæmia has been reported, but it must be remembered that failures are not usually reported. The enlarged glands subside more slowly than the enlarged spleen, as a rule. On account of the multiple localizations the exposures are generally more numerous and more intense than in leukæmia and by effects are more frequently observed. Hard or high vacuum tubes are usually used. Guerra, according to Schirmer, enhances the activity of the rays by preliminary subcutaneous injections of methylene blue. Levy Dun recommends the radical exposure, that is the exposure of both sides of the focus in order to ensure deeper penetration of the rays. He advises having the tube at about 30 cm. distant from the patient. He thinks too abrupt absorption of the pathological masses is liable to be injurious. He has observed two cases in which retrogression of sarcomatosis was attended by conditions suggesting collapse, profuse sweating, etc.

Heineke[1] states that the glandular tumors of Hodgkin's disease generally respond with prompt retrogression to treatment by the Roentgen ray, though some cases are refractory. I have seen several cases which proved wholly so despite the persistent x-ray treatment.

EXOPHTHALMIC GOITRE.

Theory as to the Cause of Exophthalmic Goitre. Contributions to the literature of this subject have been abundant, particularly in regard to treatment; a general resumé of the affection is contained in Dock's[2] study of thirty-two cases. That the pathogenesis is still in doubt is seen in the conflicting views held by various writers. Stein[3] who has had the opportunity to observe many cases, and of late six for an extended period of time, regards the disease as a degeneration of the thyroid in which relapses occur and certain toxic substances gain entrance to the system, producing the symptoms of Graves' disease. An objection to the nervous origin of the disease is the failure to find a constant change in the sympathetic system at autopsy, for many severe forms of the affection do not show any change; or, on the other hand, instances in which pathological changes are encountered are by no means so pronounced that any characteristic lesion can be claimed. Stein believes a study of the symptoms of exophthalmic goitre makes plausible the assumption of a toxic cause; the tachycardia, mental alteration, sweats, prostration, temperature disturbances and diarrhœa all correspond to symptoms seen in other intoxications. Moreover, the results obtained after extirpation of the thyroid and the

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[1] Deutsche Zeitschrift f. Chirurgie, Leipsic, lxxviii. 1 und 3
[2] American Medicine, February 24, 1906.
[3] Wiener med. Woch., November 25, 1905.

amelioration of symptoms following the administration of antithyroid serum indicate this origin of the disease.

Gordon[1] holds, on the contrary, that most of the data point to the nervous origin of the affection. He concludes that the immediate cause lies in the sympathetic nerve which with its three ganglia is the source of the ocular filaments, the accelerators of the heart and the vasomotor dilators of the thyroid. The nuclear origin of the vasodilator nerves of the cervical sympathetic system is located according to Dastre and Mara in the medulla. Comparative study shows that the results following operation on the sympathetic nerves are superior to the administration of antithyroid serum or thyroidectomy. All the symptoms of the disease are not explained by the theory of hyper- or hypothyroidization, for if the poison is excreted in excess, or if an insufficient quantity of glandular secretion is the fault, why should it only affect the cervical sympathetic and not the system in connection with other large arteries. Why are numerous cases observed in which exophthalmos is enormous and tachycardia moderate, or enormous goitres in connection with pronounced tachycardia and moderate exophthalmos? Gordon cites a case to support his view in which a middle-aged woman was suddenly affected with exophthalmos, followed in a few days by prominence of both eye globes and other symptoms of Graves' disease. On examination the third, fourth, and sixth cranial nerves were affected equally on both sides; this involvement preceded a rapid if not immediate development of the exophthalmic goitre.

Symptoms. Obviously such divergent views leave much to be desired in the understanding of exophthalmic goitre; further study and observation of cases, more complete histological examination and research as to the physiological properties of the thyroid will do much to advance our knowledge of this disease. The analysis of Dock's cases is a study calculated to provide data of this character. Of the thirty-two cases, twenty-nine were women and three men; the extremes of age were nineteen and fifty-five years; the greatest number (eight) occurring from the twenty-first to the twenty-fifth year of life. Predisposing causes could not always be discovered although twelve of the patients gave histories which may have had some influence in the development of the disease. In six cases, goitre was the first symptom noticed, but in twelve others a goitre was present from three to thirty-seven years before the other symptoms appeared. The thyroid was enlarged in all instances, and a murmur over the thyroid could be heard in twenty-six of the cases. Tachycardia was almost always present, and usually persisted even when improvement was noted in other respects; the heart's apex showed displace-

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[1] New York and Philadelphia Medical Journal, November 4, 1905.

ment to or beyond the nipple line in twenty-one cases. Blood pressure was uniformly high, and in all cases was influenced to a greater or less extent by treatment. Ocular symptoms were absent in only three cases. All the patients exhibited weakness, and in twenty-five emaciation more or less pronounced was noted. The gastrointestinal tract presented a variety of symptoms: thus alternating attacks of diarrhœa and constipation were present in ten patients; diminution of hydrochloric acid occurred in a number of instances, but in association with good motor power or even hypermotility. Two of the patients died, one from a complication and the other with acute symptoms coming on eight months after the onset of the disease. Many of the cases were chronic, but all emphasized the value of their early treatment.

In a discussion of the *larval forms of exophthalmic goitre*, Mettler[1] claims that a tabulation of the so-called symptoms of the disease shows upward of seventy-five clinical phenomena. These he divides separately into: (1) typical symptoms; (2) doubtful symptoms; (3) mere complications and associations.

The atypical cases are more common than is usually supposed. They have a favorable prognosis and are readily amenable to treatment.

The "Formes Trustees" of the French give symptoms in which tachycardia, general nervousness, tremor and possibly slight evanescent struma or exophthalmos occurs. The heart irregularity comes on suddenly after slight strain or sudden shock, and usually in women of an hysterical or neuropathic temperament. With these symptoms are combined, possibly, mild psychosis, hyperidrosis, vertigo, aboulia, weakness and even some general emaciation. These cases are not infrequently mistaken for simple neurasthenia, tuberculosis and other affections.

The association of *diabetes* and *exophthalmic goitre* has been recognized for some time. Cases are recorded in which the diabetes was the preceding disease, but more frequently the two affections develop synchronously or the goitre has antedated the diabetes. An example of this kind has come under the observation of Elliott[2] and in addition to the disease mentioned there existed nephritis, mitral disease and retinitis.

Bettmann has proven that the administration of thyroid will produce *glycosuria* in normal individuals; twelve out of twenty-five healthy people developed glycosuria after the use of thyroid. This disproves the old belief that a predisposition was necessary to induce glycosuria. The action indicates some influence over carbohydrate metabolism and leaves us to accept the conclusion that the perverted thyroid activity of exophthalmic goitre is at least a factor in producing the associated glycosuria. The most reasonable explanation according to Elliott is that

[1] Chicago Neur. Soc., March 29, 1905.
[2] Journal of the American Medical Association, June 17, 1905.

it is a toxic glycosuria, and the appearance of sugar in the urine can be looked upon as increasing thyroid toxæmia, and, therefore, may be of prognostic value.

No distinct association exists between *Graves' disease* and *nephritis,* although transitory albuminuria has been noted during periods of acute disturbance, and while chronic Bright's has not been numbered among the epiphenomena of exophthalmic goitre, there is no reason to believe that the toxæmia is incapable of setting up degenerative renal changes if long continued enough.

Exophthalmic Goitre in Infancy. The disease is a rather uncommon one in children, and some authors are disposed to regard the symptoms as being less severe than in adults. Batchelor[1] reports a case occurring in a child aged three and one-half years; previously to an attack of whooping-cough the child had always been well. The affection began with exophthalmos and nervousness; this was followed in three months by the appearance of the goitre, tachycardia and pulsation in the neck. At the age of six years and four months, the child, who had been weakened by several attacks of intercurrent disease, died from exhaustion.

The case observed by Burns[2] occurred in a newborn infant, cyanosis with frequent attacks of dyspnœa were noticed for several days after birth, and a thyroid enlargement was found on examination. The child died on the ninth day and at autopsy an enlarged thyroid showing cystic changes was found. Stephenson's[3] case, a twelve-year-old boy, began with swelling of the eyelids, which was diagnosed as angioneurotic œdema. Four months later, as other symptoms had developed, the diagnosis was simplified. Stein has called attention to this sign, œdema of the eyelids, and claims it frequently occurs and is often overlooked.

Treatment. The principles underlying the modern treatment of exophthalmic goitre are well understood, and have been fully discussed in previous numbers of PROGRESSIVE MEDICINE. It remains for us to analyze the reports of the different methods used in order to assign to each its relative worth.

Christians[4] has treated eighteen patients and reports very encouraging results following the administration of the *blood of thyroidectomized goats.* The blood was desiccated and given in tablet form, each tablet containing 0.35 gram. The treatment is symptomatic, requiring to be kept up continuously the same as the use of thyroid extract in myxœdema, but the improvement obtained justifies its use. Nervous tension relaxed, the patients were able to sleep better, digestion and general nutrition

[1] British Journal of Children's Diseases, 1905, No. 2.
[2] Canada Lancet, March, 1905.
[3] British Journal of Children Diseases, 1905, No. 2.
[4] Hospitalstidende, Copenhagen, xlvii. No. 52.

were markedly improved, the sweating and tremor ceased. In the mild cases the progress of the disease is arrested, and in the severer ones, it protects the organism against further damage from the toxic cause. The author does not believe that the treatment has any influence on organic changes which have already been established. The results obtained by Kuh[1] were even as gratifying, particularly striking was the rapid improvement in the subjective condition of most of the patients. Within a few days after taking the first dose they would report a change for the better. The serum influences the pulse as much as anything that is employed in the treatment of tachycardia in exophthalmic goitre. While permanent results may not be obtained, yet one can reasonably expect that after some time smaller and less frequent and even intermittent doses may suffice. One patient has been without treatment for two-and-one-half years and remains in excellent health. The remedy does good in especially protecting the heart from long-continued overwork. It also may hold the disease in check sufficiently long to allow the patient to regain strength when the process may disappear. That its use is not limited to therapeutic purposes is demonstrated by a case of Stein's.[2] The patient had symptoms strongly indicating Addison's disease, but after the use of the serum the symptoms disappeared, leaving the nature of the affection apparent.

It is advisable to begin treatment with small doses; if given too strongly the symptoms of myxœdema may be produced. Therefore, the amount should be gradually increased from 15 gtt. twice daily, taking the heart's action as a guide to the serum's action. In severe forms, 40 to 50 drops can be given twice daily but eight hours should elapse between doses. The case of During indicates that care must be used in giving the serum, for the patient after taking 200 cm. in two-and-one-half months developed a slow, irregular pulse, an oppressive feeling in the cardiac region, prostration, and loss of memory. Two weeks after the treatment was discontinued the symptoms disappeared.

Dock contends that the use of *thyroid extract* in exophthalmic goitre is not as irrational as many think. He argues that if the harm is done by a morbid secretion it might be supposed that supplying the organism with a normal substance would assist in carrying the forces along until the function became normal. He accordingly gave thyroid powder and tablets in nine cases of Graves' disease. While he obtained a diminution in the size of the goitre in some cases, and in others a favorable influence upon the heart's action, yet many showed decided toxic effects and still others were not influenced at all, indicating that the substance is at times inert.

[1] Proceedings of Chicago Neurological Society, March 29, 1905.
[2] Loc cit.

Bull[1] reports a case of Graves' disease with acute symptoms and death probably caused by the use of thyroid extract. The woman, aged twenty-four years, had had a goitre for three or four years, rapid heart action and throbbing in the neck. To reduce the swelling of the thyroid she took 5-grain tablets of thyroid extract for over a year when the acute manifestations appeared.

Dock gave *thyroidectin* to seven of his cases, and although improvement followed its use in most instances, yet he is not convinced that the process was more rapid or otherwise different from those treated without thyroidectin, but the same in other respects.

The effect in several cases is seen in the case reported by Mix. The patient showed evidence of weak cardiac action; rapidly increasing œdema with ascites, pulse 140 to 150, and was twenty pounds under weight. Serum was given in 2 c.c. doses three times daily, was reduced to 1 c.c., finally abandoned, and dry serum given. The serum of a thyroidectomized horse was injected and the patient grew worse; but improved again when goats' serum was taken, the pulse falling to 111 per minute. The author believes that there is a neutralization point, for if he gave too large doses hypodermically, the patient would have marked symptoms of cardiac failure, resembling those of angina pectoris and accompanied by pain in the arm. The danger of collapse was so great that on one occasion stimulants had to be given. After the dose was decreased there was improvement. On the other hand too little may be given, for in the case of ascites he reduced the dose to 10 grains a day, and the patient grew worse. She was able to take 15 grains daily without any particular difficulty and he anticipates in the course of time a lessened amount.

Diphtheria Antitoxin. Legge[2] in treating a case of diphtheria complicated by Graves' disease noticed a diminution in the size of the goitre which had been present for eight years, and a marked improvement of the nervous systems. He was led from this experience to use the serum in two other cases. In the first, a woman aged twenty-two years, who possessed a goitre of six years' duration, 2000 units were injected on two occasions. Ten days later the pulse rate had fallen from 90 to 85, the tumor had diminished 1 cm. in size, and at the expiration of four months the tumor was nearly gone. The second case was more pronounced in character, and the disease had persisted for two years. Following two injections of serum, 2000 units each, all the general symptoms improved, and in five months' time the goitre had been reduced to one-half its former size. Whether in the first case the toxins of the diphtheretic process had any effect in producing the excellent result, or whether the goitre

[1] Journal of the American Medical Association, May 6, 1905.

[2] Ibid., April 22, 1905.

recovered spontaneously, is not clear. If on the other hand, the antitoxin had any effect, and the author believes the following cases corroborative in this respect, the discovery should act as an important therapeutic aid in the treatment of Graves' disease.

Walsh[1] has used *desiccated parathyroid* in two mild cases of exophthalmic goitre, and obtained improvement. In two cases in whom the disease was present in a more severe form, he failed utterly to aid the affection and in one instance caused an exacerbation of symptoms somewhat as if thyroid extract had been given. In fact, it may be possible that the preparation given may have contained some thyroid substance.

Quinine has been given in Graves' disease because of its vasoconstricting action on the vessels of the head and neck, thereby rendering the goitre smaller, diminishing pulse rate and even reducing the exophthalmos. Hewitt[2] gave the *neutral bromide* in 5-grain doses twice daily. Two of the patients are now taking 20 grains and the third 15 grains; none have shown symptoms of cinchonism. One patient under treatment for thirteen months increased in weight, the nervous symptoms largely disappeared, a troublesome diarrhœa improved, and the goitre and exophthalmos are less noticeable. The other two patients gained in strength and in general health.

Jones[3] obtained remarkable results in a case treated by *mineral waters*. The patient was prescribed a course of Llangammarch mineral water, attention also being directed toward hygiene and proper exercise. Improvement was soon noticed, the pulsations were less frequent and less violent and subsided to 94 per minute. Seven months later he was free from palpitations and was able to attend to his business. The water is considered beneficial because of the chloride of barium which it contains. This drug has an action in slowing the pulse similar to that of digitalis. Emphasis has been laid upon general and systematic measures in the treatment of exophthalmic goitre and many cases owe their improvement to such means. It is likely that some of the cases above mentioned improved as much under change of life in connection with better hygienic conditions and rest as they did through the administration of certain remedial agents. Dock considers the elements of treatment most useful to be rest, care of the gastrointestinal tract and the skin, with special attention to the heart, nervous system and other organs when necessary.

The results obtained in the *surgical treatment of Graves' disease*, with a consideration of methods to be employed, have been fully discussed in the number of PROGRESSIVE MEDICINE for December, 1905. Hirst[4] has

[1] American Medicine, May 20, 1905.
[2] Medical Times, January, 1905.
[3] Lancet, April 1, 1905.
[4] Journal of the American Medical Association, 1905, p. 1957.

collected sixty-nine cases operated upon for conditions other than strumec-
tomy, which together with Sanderson's six makes a total of seventy-five.
Of this number thirteen died. In all these fatal cases the cause of death
is expressly stated to be acute thyroidism, with tachycardia to an extreme
degree and eventual heart failure. In one case of appendicular abscess
the patient died of combined effects of sepsis and thyroidism. In another
case of pelvic abscess, the patient died under chloroform before the
operation was begun. Excluding these two, the mortality from thy-
roidism was 14.6 per cent. or including them 17.3 per cent. The nature of
the operation seems to have made little difference in the results. The mor-
tality of the minor operations was 16 per cent., that of hysterectomies and
myomectomies 13.3 per cent. It appeared, therefore, that the existence
of exophthalmic goitre adds about 15 per cent. to the mortality of any
operation performed upon the patient. In the first of Hirst's patients
there had been a distinct goitre and exophthalmos for years, but the
tachycardia was moderate. The symptoms in this case were never
very alarming and soon yielded to treatment. It was not known that
the second patient had the disease until two days after operation, when
the pulse rose to 180, the eyes protruded and the neck enlarged. Al-
though some improvement was shown after hypodermoclysis, purgation,
and heart stimulation given on the first day after symptoms appeared, a
rapid and complete recovery was secured in the next three or four days,
apparently in consequence of the administration of suprarenal extract
in 3-grain doses every four hours.

OPHTHALMOLOGY.

By EDWARD JACKSON, M.D.

DISEASES OF THE CONJUNCTIVA.

Bacteriology of Conjunctivitis. Most studies of the bacteria found in the conjunctiva, have dealt with single types of disease or comparatively small numbers of cases. Such studies throw little light on the relative frequency of the different forms. Even when the various investigations are brought together great uncertainty remains as to the significance of the resulting statistics. Large numbers of cases must be studied, the investigation extending over prolonged periods, to furnish thoroughly reliable data. Even such an investigation made in one locality may not give any correct idea of the relative frequency of the different forms in other places.

An important start has been made in this direction by Pollock,[1] who studied cases of acute and subacute conjunctivitis applying at the Glasgow Eye Infirmary, over a period of two years; by Meyerhof,[2] who examined 300 cases at Cairo, Egypt; and by Smith,[3] who made bacteriologic studies of 65 cases of conjunctival infection in New York and Bridgeport, Conn. The impossibility of inferring from studies made in one locality the relative frequency of different forms of conjunctival affections in another locality is illustrated by giving some of the results obtained by these investigators in parallel columns:

| | Number of cases. | | |
Form of Bacteria.	Pollock, Glasgow.	Meyerhof, Cairo.	Smith, N. Y.
Total cases	362	300	65
Weeks bacillus	190	157	1
Diplobacillus of Morax and Axenfeld	62	37	6
Pneumococcus	12	10	12
Gonococcus	21	80	3
Staphylococcus	13	. .	13
Streptococcus	2	4	3

In Pollock's 362 cases of mucopurulent conjunctivitis, 75 per cent. showed the Koch-Weeks bacillus. Among the 69 subacute cases only 7 showed the Weeks bacillus, while 51 showed the Morax-Axenfeld

[1] Transactions of the Ophthalmological Society of the United Kingdom, vol. xv.
[2] Klinische Monatsblätter f. Augenheilk., September, 1905.
[3] Archives of Ophthalmology, September, 1905.

diplobacillus, which was found in only 9 of the acute cases. The Weeks bacillus was the organism found in 5 cases of purulent conjunctivitis, 2 of which were of ophthalmia neonatorum. The gonococcus was found in 17 cases, 2 of acute mucopurulent, and 15 of purulent conjunctivitis, 10 of the latter being ophthalmia neonatorum. The gonococcus was found with other organisms in 4 other cases. The pneumococcus was found alone in 6 cases of acute mucopurulent and 3 of purulent conjunctivitis, 2 being ophthalmia neonatorum. In 4 other cases it was found with other organisms. The pyogenic staphylococci were found in 6 cases of acute mucopurulent and 2 of membranous conjunctivitis. Of the total 362 cases the results were indefinite or negative in 62. Probably this was because it was impossible to make sufficiently thorough examinations or to repeat them before treatment had essentially modified the aspect of the case.

Pollock admits that we are not yet able to adopt an etiological classification of conjunctivitis. But some important facts must be regarded as established. The Weeks bacillus, the diplobacillus of Morax and Axenfeld, and the gonococcus are never found in the normal conjunctiva. Other observers say they may be found in the healthy conjunctiva, though rarely. The finding of either of these is positive evidence that it is related to the conjunctival disease present. On the other hand the pneumococcus, streptococcus and the staphylococcus are often found in the normal conjunctiva. Their mere presence cannot be assumed with certainty to have pathologic significance, although it may be regarded as certain that in some cases they cause conjunctival inflammation. The same attitude must be taken toward certain other bacteria, as the common colon bacillus and the bacillus subtilis.

Even with regard to the bacteria known to be pathogenic, it is well-established that the same organism is perfectly capable of causing the most widely different grades and even different forms of inflammation. Still, if one picked out the cases of acute mucopurulent conjunctivitis with a history of infection of one eye following the other, the Weeks bacillus would be found present in a very high proportion; while in subacute conjunctivitis, or blepharoconjunctivitis, with little discharge and moderate redness toward the canthi, an equally large proportion of cases would show the diplobacillus. Indeed among Pollock's subacute cases the positive results were diplobacillus 51 and Weeks bacillus 7. And the indefinite or negative results 11 might readily be accounted for by uncertainties of a single examination when so little discharge was obtainable.

Among the cases of *ophthalmia neonatorum* the gonococcus was present in but 13 out of 18. Pollock points out that a bacteriological examination can alone give the correct diagnosis in cases of purulent and membranous

conjunctivitis. This is illustrated in a series of cases of severe *pseudo-membranous conjunctivitis*, reported by Strzeminski,[1] in which in the absence of a bacteriological examination inefficient treatment was continued for several days, until demonstrating its futility, when the use of *antitoxin* was followed by prompt recovery.

There seems to be no reason why in any doubtful case antitoxin should not be given at once if the symptoms include a membranous deposit, and are at all severe. Even in cases of croupous conjunctivitis, due to organisms other than the Klebs-Loeffler bacillus, Christ[2] states that diphtheria antitoxin has a favorable influence, although this seems very much less than in true ocular diphtheria.

Staphylococcus conjunctivitis, which occurred most frequently in Smith's cases, but is not included by Meyerhof, has been especially studied by Poulard,[3] in Paris. He finds it not very common there. Only 9 cases were encountered in the clinic at the Hotel Dieu in two and one-half years. Its peculiarities are that it remains unilateral, the secretion is moderate, and mucopurulent in character. The preauricular gland of the affected side becomes swollen and tender to pressure. The inflammation begins to subside in 5 or 10 days, but lasts altogether 20 or 30 days. The cornea remains unaffected. This latter point is at variance with Smith's observation. He noted 2 cases of corneal infection. The practical importance of conjunctival bacteriology, according to Fergus,[4] in whose clinic Pollock's examinations were made, lies in three directions: (1) It is an important aid to diagnosis; (2) it is a guide in determining the safety or risk of an operation that may be needed; (3) it materially influences treatment.

Treatment of Conjunctivitis. The influence of the knowledge of the bacteriology upon the treatment of conjunctivitis is strikingly shown in the form of disease produced by the diplobacillus of Morax and Axenfeld. As illustrated by Pollock's statistics, most cases have already become subacute or even chronic before they come under observation. They often tend without treatment to persist indefinitely; while under treatment with zinc sulphate, the cure is generally regarded as rapid and certain. Gifford,[5] however, calls attention to the obstinacy of some of these cases, even under specific treatment. He had employed and recommended zinc chloride, one grain to the fluid ounce. But since then he has used it in 2 per cent. solution applied to the everted lids and then rinsed off. Cases in which this was used for several weeks had returned with renewed symptoms a short time after its discontinuance and he

[1] Recueil d'Ophtalmologie, October, 1905.
[2] Beiträge zur Augenheilkunde, May, 1905.
[3] Archives d'Ophtalmologie, October, 1905.
[4] British Medical Journal, March 11, 1905.
[5] Ophthalmic Record, November.

is not sure that the 1 per cent. solution of zinc sulphate is any better than the zinc chloride.

Sodium hyposulphite has been brought forward by Trousseau[1] as an application in conjunctivitis. In chronic catarrhal conjunctivitis it is particularly valuable. In cases that had resisted for months the classic applications of cyanide of mercury, zinc sulphate, silver nitrate, etc., the discharge was checked abruptly by a four or five days' use of the hyposulphite. He has employed it in 5 per cent. solutions, which he finds is never irritant. It is used freely as a collyrium, or to irrigate the eye, to moisten compresses, or to wash out the lacrymal passages. The hyposulphite of commerce is liable to contain free sulphuric acid, which should be guarded against.

Ophthalmia Neonatorum. A fatal case of this disease is reported by Stevens.[2] The improvement in the ophthalmia had been rapid and satisfactory, and cure was about complete; when on the thirteenth day joint involvement was noticed, first in a metacarpal articulation, then in a knee, the opposite ankle, and an elbow. After this endocarditis coma and death occurred, seventeen days after the beginning of the ophthalmia.

In the Manz-Sattler Festschrift, Dahlstroem[3] brought together some nineteen reported cases of arthritis complicating ophthalmia neonatorum, and two of these cases terminated in death. In nearly all of them the presence of the gonococcus has been fully established. In Stevens' case gonococci were demonstrated in the vaginal discharges of the mother, the conjunctival discharge, and the pus obtained from one of the affected joints.

For the *treatment of ophthalmia neonatorum,* two observers of wide clinical experience, Pfalz,[4] of Dusseldorf, and Hotz,[5] of Chicago, have urged anew the value of protargol. They regard it as possessing all the valuable efficiency of silver nitrate, without its undesirable actions.

Conjunctival Irritation from Proximity to a Horse. Three cases of this condition are reported by Posey,[6] who has been unable to find any previously reported cases. It cannot, however, be extremely rare, for although I have only seen two cases, I have met several persons who were familiar with it.

Those who have this idiosyncrasy suffer whenever they ride behind a horse or approach one in a stable. The conjunctiva becomes swollen and hyperæmic, there is itching, a sensation of intense irritation, and

[1] La Clinique Ophtalmologique, March 10, 1905.
[2] Ophthalmic Record, November, 1905.
[3] Klinische Monatsblätter f. Augenheilk., Supplement, 1903.
[4] Zeitschrift für. Augenheilk., March, 1905.
[5] Chicago Medical Recorder, April, 1905.
[6] Journal of the American Medical Association, June 3, 1905.

excessive lacrymation. The sensations are aggravated by rubbing the eyes, and there is sneezing and other symptoms of hay fever. The time of year has little or no influence upon the attacks. Avoidance of the cause seems to be the only effective remedy. Posey also mentions that Weir Mitchell, in a research on cat fear, has come across many cases of conjunctivitis caused by the nearness of cats, and de Schweinitz, in the discussion, reported a case in which stroking a cat produced sharp conjunctivitis.

Trachoma. The importance that attaches to trachoma on account of its wide distribution is enforced by the monograph of Hirschberg,[1] and illustrated by statistics compiled by Kuwabara,[2] showing its prevalence in Japan. The latter writer examined all the (1301) inhabitants of a village. Among the 347 families he found 312 presented cases of trachoma. The proportion of cases was 72 per cent. Among the school children it ranged from 57 to 88 per cent. Of men 77 per cent., and of women 74 per cent., gave evidence of trachoma. He, also, gives cases showing the wide diffusion of the disease throughout that country.

The *contagiousness* of trachoma is generally accepted, but Poulard[3] gives a very striking instance of a focus of infection involving all the members of one family and their intimate neighbors. Straub,[4] while admitting that trachoma is a contagious disease, thinks it is practically only contagious among children one or two years old. This is negatived by the instances of contagion of which ophthalmic surgeons have been the victims and the number of acute cases of trachoma which formerly developed among adults in the steerage passage across the Atlantic. Such a view as is put forth by Straub probably has a similar foundation to the Chinese view that smallpox is a disease of childhood, and not contagious among adults. The prevalence of trachoma among certain classes in Holland resembles the prevalence of smallpox in China.

As to the specific organism which causes trachoma the results of the latest investigations seem quite negative. Luerssen[5] finds that cultures of the Mueller bacillus inoculated into the conjunctiva do not cause trachoma. Pfeiffer and Kuhnt[5] using ultra-microscopic methods were unable to demonstrate any thing that could be regarded as the cause of trachoma.

TREATMENT OF TRACHOMA. Trial of the x-ray treatment of trachoma still goes on, and a painless method that promised to render unnecessary operative measures and the prolonged use of painful irritants was hailed

[1] Klinische Monatsblätter f. Augenheilk., November, 1905.
[2] Archives d'Ophtalmologie, August, 1905.
[3] Ophthalmology, July, p. 817.
[4] Zeitschrift f. Augenheilkunde, November, 1905.
[5] Ibid., April, 1905.

with enthusiasm. Wider experience, however, has failed to sustain the claims made for this method two years ago.[1] Favorable reports regarding it have been made by Newcomet and Krall,[2] and Vassiutinsky,[3] Horniker and Romanin[4] have devised an elaborate apparatus for holding the lids everted during the exposure to the ray. Still the new treatment has failed to secure adoption as the usual method in any important clinic. Vassiutinsky finds that the granules disappear quite slowly. Harman[5] reports that three cases treated with the x-ray, one of them having fifty exposures in five months, showed no material improvement. My own experience has been disappointing. With frequent exposures some cases showed decided improvement, but the worst cases never approached cure, and no case continued to improve so rapidly under the x-ray as under applications of copper sulphate, etc. It must be remembered that not all cases tend persistently to grow worse, or to continue indefinitely without treatment. In some cases the disease is self-limited; in others it improves promptly under ordinary treatment. New methods of treatment must prove their usefulness by curing cases the obstinacy of which has been demonstrated. Again, so-called follicular conjunctivitis or follicular trachoma is often not trachoma or anything allied thereto. But as Stevens[6] points out it is merely conjunctivitis in an eye that has unusually large lymph follicles.

RADIUM FOR TRACHOMA. The above facts must be borne in mind in judging of the claims made for radium in the treatment of trachoma. Cohn,[7] Belenkovski,[8] Falta,[9] Beck,[10] and Thielemann[11] have each reported a few cases treated with radium, the total number being seventeen. Of these thirteen are reported cured and the others showed marked improvement. The method of treatment was to hold a tube containing the radium in contact with the everted lid, or to touch one follicle after another, or gently massage the lid with the tube. This was continued from ten to thirty minutes daily or at longer intervals.

Pterygium. The old combat between the view of Alt, that pterygium is caused by marginal ulcer of the cornea, and the view of Horner and Fuchs, that it arises from pinguecula, has not resulted in victory for either

[1] PROGRESSIVE MEDICINE, June, 1904.
[2] Medical News, March 25, 1905.
[3] Roussky Vratsch, January 8, 1905.
[4] Zeitschrift f. Augenheilkunde, December, 1905.
[5] British Medical Journal, August 26, 1905.
[6] Ophthalmic Record, December, 1905.
[7] Berliner klinische Wochenschrift, No. 8, 1905.
[8] Roussky Vratch, May 14, 1905.
[9] Wiener med. Wochenschrift, 1905, No. 31.
[10] Annals of Ophthalmology, July, 1905.
[11] Zeitschrift f. Augenh., December, 1905.

party. The later investigations seem inclined to regard both origins as probable. Alt,[1] whose earlier investigations supported the marginal ulcer hypothesis, finds from a wider   ly of pinguecula and beginning pterygium that the one runs over into the other. In advance of the pterygium he has discovered a destruction of Bowman's membrane by an army of leukocytes. There is a slow inflammatory process, and the tissue of the conjunctiva and the pinguecula are slowly dragged over the cornea. As the process goes on the characteristic tissue of the pinguecula is gradually lost. The characteristics of pinguecula are the deposits of hyalin and elastin and the increase of elastic-tissue fibres, either by hypertrophy of pre-existing fibres or by the development of new ones. The epithelial proliferation, which Alt noted in his earlier studies of pinguecula, he now finds is not a constant or usual feature.

The usual theories of pterygium and pinguecula fail to give a thoroughly satisfactory explanation of their common restriction to the nasal side of the cornea. Sachsalber[2] finds an explanation in irritation caused by the fine, almost colorless hairs that grow from the caruncle. These can seldom be seen without a magnifier, but he has found them reaching 2 mm. beyond the corneal limbus. In an examination of more than one thousand inmates of a hospital for the insane, he found these hairs in all but three of the persons presenting pinguecula, and in almost all cases of progressing pterygium.

The tendency of pterygium to grow farther and farther upon the cornea is ascribed by Shastid[3] to the formation of minute canals under the head of the pterygium by the adhesion of the abraded conjunctiva to the abraded cornea. These adhesions occur at the nasal side of the cornea because of the pushing or rolling over of the conjunctiva on to the cornea by the movements of the eyeball against the lids. Such canals, Shastid believes, form peculiarly favorable places for the development of bacteria, and the bacteria furnish an irritant which keeps up the inflammation and makes the case progressive. Shastid believes he has demonstrated such canals by the passage of minute probes into them. They have not been shown by microscopic investigation.

Marginal ulcer, Shastid holds, does not cause pterygium if the abraded surface is continuous from the conjunctiva on to the cornea, so that no epithelial crypt or canal is included beneath the overlapping conjunctiva. He points out that eyes suffering from pterygium frequently present small encroachments of the conjunctiva upon the corneal margin in positions other than to the nasal side, but that these encroachments are never progressive because the conditions are not favorable to rolling the con-

[1] American Journal of Ophthalmology, September, 1905.
[2] Wiener klin. Wochenschrift, 1905, No. 29.
[3] Ophthalmic Record, October, 1905.

junctiva over unabraded cornea to secure an adhesion that will leave
a canal beneath it.

THE TREATMENT FOR PTERYGIUM which Shastid bases upon his idea
of the pterygium canal is to cauterize the canal with a fine wooden probe
dipped in carbolic acid and wiped dry. This is inserted and allowed
to remain in the canal several minutes and the cauterizing repeated,
if necessary. After this is accomplished the pterygium may be excised
with a narrow cataract knife. He believes, too, that something may be
done in the way of non-operative treatment by frequent flushing out of
the groove at the margin of the pterygium and the canal beneath it
by antiseptic solutions, or the diminution of vascularity by adrenalin
preparations.

Alt removes the pterygium from the cornea as cleanly as possible,
and by converging incisions removes a rhomboidal piece. He next
makes a "free cut through the conjunctiva at the limbus upward and
downward, so as to relax this membrane perfectly." He then cauterizes
the corneal wound vigorously with pure carbolic acid, applies no sutures
and closes the eye. In several hundred cases he has seen very few relapses.

Very much the same operation is done by Lopez,[1] who extends his
incision along the corneal margin 5 mm. above and below the borders
of the growth. He passes a thread through the detached head of the
pterygium and underneath the conjunctiva toward the caruncle. This
suture is removed at the end of forty-eight hours. After this operation he
has no recurrences.

Malignant Disease Starting in the Conjunctiva. A case which does not
fit the current classification of conjunctival tumors is reported by Fergus.[2]
When first seen the bulbar conjunctiva was covered "with sprouting
vegetations not at all unlike those which are seen in some cases of severe
spring catarrh." They were soft, pale, and covered by frothy mucous
discharge. This condition had begun about six months before. The
tissue was removed and submitted to a pathologist, but the report upon
it did not clear up the diagnosis. In two months the tumor had recurred.
It had extended in the orbit and preauricular region, caused extensive
absorption of the bones of the skull, and grew larger than the patient's
head. Professor Muir, who examined one of the growths, was inclined
to regard it as sarcomatous. Mr. Parsons, who had made a study of it,
inclined to the view that it was not a lymphosarcoma but a carcinoma.
Both agreed that its structure indicated high malignancy.

[1] Recueil d'Ophtalmologie, February, 1905.
[2] Transactions of the Ophthalmological Society of the United Kingdom, vol. xxv.

DISEASES OF THE CORNEA.

Corneal Ulcers with Teething. Frazier[1] reports the case of a healthy baby, in which as each tooth erupted through the gum a corneal ulcer appeared in the eye of the same side as the erupting tooth. When the tooth came through the ulcer disappeared with little treatment.

Varicella Ulcer of the Cornea. Oppenheimer[2] reports a case in which the eye became inflamed on the sixth day of an attack of varicella. Two days later the conjunctiva and lids were red and swollen with some mucopurulent discharge. A small vesicle was found on the cornea, which next day had become an ulcer. The ulcer healed without complication. Oppenheimer was able to find but two similar cases that had been previously recorded.

Diplobacillus Ulcer. The importance of the diplobacillus of Morax and Axenfeld as a cause of corneal ulceration is enforced by the papers of Paul,[3] who reports 26 cases of severe ulcer with hypopyon and iritis from this cause; Stoewer,[4] who encountered 32 diplobacillus ulcers among 93 corneal infections, and Erdman,[5] who, among 14,783 cases of eye disease in the Rostock Clinic, recognized 342 as cases of diplobacillus conjunctivitis, thirty of which were complicated by corneal ulceration. The diplobacillus is also mentioned by zur Nedden[6] as one of the causes of serpent ulcer. Of Erdman's cases eight were accompanied by hypopyon and iritis, and four of these required the cautery, or Saemisch section.

Erdman was able to produce conjunctivitis with the seventh culture of the diplobacillus on glycerin agar. He found that pieces of linen soaked in the conjunctival discharge gave growths of the organism after being dried and kept at ordinary temperatures for two weeks. He also found the diplobacillus in the nasal secretion of 42 out of 67 cases of diplobacillus conjunctivitis in which that secretion was examined; and in 142 cases in which no diplobacilli were found in the conjunctiva, they were found sixty-four times in the nose, although the mucous membrane appeared normal. As to treatment: these writers all agree as to the value of the zinc sulphate in 0.5 per cent. solution; or zinc-ichthyol ointment, as recommended by Peters.

Corneal Ulcer from Bacillus Pyocyaneus. Cases of corneal infection by this organism are reported by McNab[7] and Szczybalski.[8] The case

[1] British Medical Journal, September 16, 1905, p. 681.
[2] Deutsche med. Wochenschrift, 1905, No. 21.
[3] Klinische Monatsblätter f. Augenh., February, 1905.
[4] Ibid., August, 1905.   [5] Ibid., May, 1905.
[6] Archiv f. Augenh., 1905, p. 142.
[7] Klinische Monatsblätter f. Augenh., December, 1905.
[8] Archiv f. Augenheilkunde, January 19, 1905.

reported by the latter developed ring abscess, and McNab suggests that it was this bacillus which Hanke[1] reported as a cause of ring abscess. Meanwhile Hanke[2] writing on the significance of ring abscess speaks of it as a zone of infiltration surrounding a necrotic area at the centre of the cornea, and admits that it may attend various kinds of corneal infection.

Treatment of Corneal Ulcer. The treatment of corneal ulcer with the *antipneumococcic serum* of Römer has been the subject of papers by Paul,[3] Oliveres,[4] Castresana,[5] and Römer.[6] But as in the reports of two years ago,[7] the results are so indecisive that if it were not for the strong hope aroused by the successful serum treatment in other directions, little attention would be paid to it in this connection. Paul's statistics show seven failures, and two partial successes out of fifteen cases. Oliveres reports three cases in all of which the serum proved ineffective. Castresana used it by subconjunctival injections, against the recommendations of Römer. Its use was followed by improvement, but other treatment was employed. Römer still believes in its value, but points out the difficulties that arise from the uncertainty of the serum obtained from one growth of pneumococcus proving effective against a somewhat different variety of the organism. On the whole the serum treatment seems to be less effective and less reliable than curetting, and cauterizing with the actual cautery or nitric acid.

QUININE FOR CORNEAL ULCERS. Many years' experience with the beneficial influence of quinine applied locally to corneal ulcers has induced Lawson[8] to call attention to it. He finds it most valuable in ulcers showing a large loss of surface, but not highly infective; in marginal ulcers; and in neuropathic ulceration.

He employs a solution of 4 grains of the sulphate, dissolved in 1 fluid ounce of distilled water, by the aid of just sufficient sulphuric acid. This lotion is applied to the eye four times daily in an ordinary eye cup, and the cornea is irrigated with it. In discussing Lawson's paper, Taylor, Paton, and Priestly Smith all testified to the value of quinine thus used The latter thought the hydrochlorate an equally efficient salt, and it is fully soluble without the addition of free acid. He used it in strength of 1 to 4 grains to the fluid ounce.

Normal Corneal Temperature, Nictitation and Lacrymation are three conditions to the importance of which in the treatment of corneal disease

[1] PROGRESSIVE MEDICINE, June, 1904, p. 303.
[2] Klinische Monatsblätter f. Augenheilkunde, June, 1905.
[3] Ibid., October, 1905.   [4] Recueil d'Ophtalmologie, June, 1905.
[5] El Siglo Medico, January 14, 1905, 21–28.
[6] Archiv f. Augenheilkunde, vol. lii. p. 1.
[7] PROGRESSIVE MEDICINE, June, 1904, 302.
[8] Transactions of the Ophthalmological Society of the United Kingdom, vol. xxv p. 50.

attention is called by M'Gillivray.[1] He points out that the normal corneal temperature being 10° C. or 18° F. below the body temperature must have a marked effect in retarding invasion by micro-organisms. Prolonged closure of the lids raises the corneal temperature to that of the body. The normal act of winking cleanses the corneal surface or the surface of a wound or ulcer, and lacrymation greatly assists in the process. To promote these beneficial influences M'Gillivray recommends the use of the following ointment:

Yellow oxide of mercury	2 grains
Atropine	1 grain
Cocaine	3 grains
Lanolin	2 drachms.

A piece of this the size of a split pea is to be inserted behind the lower lid three times daily.

Keratitis Due to Rheumatism. There is no *a priori* reason why the cornea should always escape the fate of tendons, endocardium, or joints, so the question is pertinent, does it escape? Connor[2] undertakes to answer this question. He concludes keratitis is sometimes caused by rheumatism; although seventy out of one hundred and twenty-nine ophthalmologists, who replied to his inquiries on the subject, had never recognized such a keratitis. He reports five cases, all of which started in the cornea during attacks of rheumatism. Some recurred many times; all other constitutional causes were eliminated; all attacks were non-suppurative. Antirheumatic treatment alone favorably promoted a rapid recovery of either keratitis or rheumatism. In all these cases the keratitis antedated any other ocular lesion, and only two were complicated by iritis.

His inquiries addressed to ophthalmologists brought the following positive results: Of primary keratitis in acute articular rheumatism, six observers reported one or more cases each; of primary keratitis in indefinite rheumatism twenty-nine observers reported one or more each; of secondary keratitis in indefinite rheumatism, twenty-eight had seen one or more cases. No specified form of keratitis is ascribed to this cause. Among sixty-three cases twenty-one forms of corneal disease are mentioned. The most frequent are superficial keratitis five, marginal keratitis four, interstitial keratitis eight, parenchymatous six, keratoscleritis fifteen, and descemetitis seven. More than two-thirds of the cases affected the substantia propria of the cornea. The only therapeutic suggestion brought out is the important one mentioned above as to the value of anti-rheumatic remedies.

Tuberculosis of the Cornea. A general study of this subject has been made by Chesneau,[3] who recognizes the following classification of cases

[1] The Ophthalmoscope, July, 1905.
[2] Journal of the American Medical Association, August 5, 1905.
[3] Annales d'Oculistique, June, 1905.

proposed by Bach: (1) Parenchymatous keratitis attributed to the influence of toxins of tuberculosis upon the true corneal tissue. The iris is apt to be seriously involved, and on this account enucleation may be necessary. (2) Sclerosing keratitis, consecutive to tuberculosis of the pectinate ligament. (3) Primary tuberculous keratitis, beginning in the sclerocorneal junction, without any previous involvement of the iris or pectinate ligament. (4) Secondary keratitis arising by extension of the tuberculosis from the neighboring conjunctiva. To these forms, Chesneau adds what he calls (5) a sclerosing parenchymatous keratitis.

Six of his seven patients affected with this latter form were females. The disease usually began as a localized episcleritis followed by a nodular lesion in the parenchyma of the cornea separated from the seat of the episcleritis, so that a narrow strip of healthy or slightly œdematous cornea intervened. As a rule the iris was not involved. The diagnosis in these cases seems to have been arrived at by exclusion. The prognosis seems good. The treatment relied upon was the general treatment of tuberculosis, and the subconjunctival injection of filtered air, 1 to 4 c.cm. at a time.

Two cases of nodular opacities of the cornea, which he regards as a superficial tuberculosis, or sort of lupus of the cornea, are reported by Wehrli.[1] Tissue from the nodules was placed in the anterior chamber of guinea-pigs with negative results. But what were believed to be tubercle bacilli were found in the tissue by microscopic examination after careful staining. The value of tuberculin T. in the diagnosis and treatment of interstitial keratitis has been urged by Stanculeano and reviewed by Hubbell.[2] In eleven cases presenting signs of hereditary syphilis there was no reaction to tuberculin in nine. The other two reacted, one of them with a typical curve. In eight cases of tuberculous antecedents, but without apparent tuberculous lesions elsewhere, the febrile reaction occurred in all, the required dose of tuberculin varying from 0.1 to 3 milligrams.

Interstitial Keratitis. *The influence of trauma in exciting syphilitic or tuberculous parenchymatous keratitis* was discussed by Perlia[3] before the Rhenish-Westphalian Society of Ophthalmologists. Perlia reported a case in point, and quoted some from the earlier literature. In the discussion other cases were cited by Nieden, Scheffels, Limbourg, Pfalz, Plange and Thier. Guillery[4] also discusses the subject, and concludes that trauma may be an important element in the causation of these cases. The same view is supported by T. Faith,[5] who reports illustrative cases.

[1] Zeitschrift f. Augenh., April, May, June, 1905.
[2] Ophthalmic Record, March, 1905.
[3] Klinische Monatsblätter f. Augenh., March, 1905, p. 396.   [4] Ibid., May, 1905.
[5] Transactions of the American Academy of Ophthalmology and Otolaryngology, 1905.

The reviewer has recently seen a case of the kind in which the inflammation began immediately after an injury, and ran the usual course of interstitial keratitis due to inherited syphilis, extending over sixteen months. At the end of three years the other eye has not been affected.

Neither the mere occurrence of interstitial keratitis, nor the age at which it occurs, can be taken as positive evidence of hereditary syphilis. Carpenter[1] reports the case of a man, aged twenty-seven years, who developed interstitial keratitis five months after a chancre of the eyelid. Consiglio[2] reports a case in which parenchymatous keratitis for hereditary syphilis occurred in one eye at the age of forty-four years, the other eye having been attacked at the age of eighteen.

Rare syphilitic lesions of the cornea have been studied by Antonei and Benedetti.[3] They include chancre of the cornea; corneal ulcer, of which cases have been reported by Antonelli[4] and Trantas;[5] true primary punctate keratitis; nodular keratitis, and gummata of the cornea. Of the latter lesion cases have been reported by Vinsonneau[6] and Terson.[7] Two cases of internal ulcer of the cornea attending syphilitic keratitis are reported by Stock,[8] who had the opportunity to study them microscopically. Dimmer[9] reports as a sequel of parenchymatous keratitis, the finding of double contour lines, semicircular in form, approximately parallel to the corneal margin and confined to the lower half of the cornea. These lines were situated in the deepest layers, and he regards them as evidence of folds in the membrane of Descemet.

Corneal Opacities. FAMILY DEGENERATION OF THE CORNEA was discussed two years ago[10] under the head of lattice-like opacities. Since that time many cases have been reported, a large proportion of them under the titles of nodular opacity, or nodular keratitis. Doyne and Stephenson[11] report regarding a family in which seven cases occurred in three generations. They recognize the lattice-like and nodular opacities as different diseases; but point out that they agree in beginning about puberty, are accompanied with insignificant signs of inflammation, attack at first and chiefly the central parts of the cornea, are slowly progressive, and probably represent degenerative rather than inflammatory processes. Fleischer[12] from an elaborate study of the subject concludes that they are but different forms of the same disease.

[1] Ophthalmic Record, December, 1905, p. 582.
[2] Beitrage zur Augenheilkunde, 1905, Heft lxiii. p. 9.
[3] Recueil d'Ophtalmologie, July, August, and September, 1905.
[4] Ibid., February, 1905.   [5] La Clinique Ophtalmologique, March 10, 1905.
[6] Archives d'Ophtalmologie, February, 1905.   [7] Ibid., May, 1905.
[8] Klinische Monatsblätter f. Augenh., Supplement, 1905.
[9] Zeitschrift f. Augenh., Supplement, 1905.
[10] PROGRESSIVE MEDICINE, June, 1904.
[11] Ophthalmoscope, May, 1905.
[12] Die Ophthalmol. Klinik, July 20, 1905.

Cases occurring in mother and child are reported by Hancock,[1] and in sisters by Dawnay.[2] In one of the latter cases the patient was but six years old. At the other extreme of life Wilkinson[3] reports a case in a man of seventy, whose vision had gradually decreased "for several years."

ABRASION OF CORNEAL OPACITIES. For definite, limited superficial opacity of the cornea, abrasion or removal of the opacity is recommended by Heilbron,[4] who also resorts to it with massage, for recurrent inflammation in corneal scars. The operation is done with a sharp spoon or small Graefe knife. The extent and depth of the opacity should be carefully studied by focal illumination, and with the loupe, before operating. The after treatment includes atropine and iodoform ointment and the use of a bandage.

Conical Cornea. Disturbance of the nutrition of the cornea is accepted by Wicherkiewicz[5] as the underlying cause of keratoconus, but he believes that there is also a slight increase of the intraocular tension in most cases. He prefers to treat it by cauterization without perforation, somewhat after the plan of Elschnig.[6] Grossman[7] has employed superheated air to cauterize the cornea, using to heat the air a platinum coiled tube placed in a Paquelin burner. The heat is regulated by varying the distance of the nozzle from the cornea. Upon applying the hot-air blast the cornea becomes white at the point of application, with a surrounding zone of gray, and it flattens almost to collapse. The gray portion soon resumes its normal transparency. The reaction is slight.

The old operation of excising the apex of the cone has been modified by Stoewer,[8] who endeavors to remove a certain amount of the diseased tissue making a small perforation into the anterior chamber, and then to secure prompt healing and safety from infection, he covers the opening so made with a conjunctival flap. The appearance can subsequently be improved by tattooing. He reports a case in which vision was improved from $\frac{3}{60}$ to $\frac{4}{20}$ by such a procedure. But this does not compare favorably with the results of cauterization, which certainly involves no more danger.

DISEASES OF THE UVEAL TRACT.

Abnormalities of the Pupil. A case of *voluntary control of the iris movements* is reported by Sherer.[9] It was first observed at the age of nine

[1] Transactions of the Ophtalmological Society of the United Kingdom, 1905.
[2] Ibid., 1905.   [3] Annals of Ophthalmology, July, 1905.
[4] Wochenschrift f. Therapie und Hygiene des Auges, April 20, 1905.
[5] Archives d'Ophtalmologie, February, 1905.
[6] PROGRESSIVE MEDICINE, June, 1905.
[7] British Medical Journal, August 26, 1905.
[8] Klinische Monatsblätter f. Augenheilk., April, 1905.
[9] Journal of the American Medical Association, May 6, 1905.

years in a girl who could also rotate the eyeballs in different directions independently of each other. She was able at will fully to dilate the pupil of either eye, the other remaining of normal size.

DILATORS OF THE PUPIL. By experimenting on the eyes of apes, with atropine and eserine, Hotta[1] has demonstrated that the posterior limiting membrane of the iris stroma, with the nuclei connected with it, constitutes a true dilator of the pupil. Parsons[2] concludes that this is also true of man. Grossmann[3] considers that he has demonstrated the absence of the dilator in the eyes of a child affected with congenital aphakia. Eserine caused the pupils to contract vigorously, showing the activity of the sphincter; but atropine caused the pupil to become "a mere shade wider," from paralysis of the sphincter. The pupils in this case were displaced upward and inward, and almost slit-like in form.

In a case of acromegaly reported by Hecht,[4] Hale found the pupils small and unaffected by light or accommodation, but the strongest mydriatic had no decided effect on the iris, and there seemed to be no synechia.

The Pupil in Phthisis. The importance of unilateral mydriasis as a sign of incipient pulmonary tuberculosis is urged by Bichelonne,[5] who believes that after the exclusion of other causes for the dilatation it becomes a symptom of great value. In sixty-nine cases examined, he found dilatation on the side of the pulmonary disease in ten. It may arise from irritation of the dilator fibres by enlarged glands in the mediastinal, thoracic, or cervical region; or from filaments leading to the lungs and pleura. At a late stage the pupil may become contracted by destruction of the same fibres.

Reflex Iridoplegia and Iris Atrophy. The Argyll-Robertson pupil, appearing as a symptom of *tabes* or *paretic dementia,* is often complicated by atrophy of the iris. The atrophy may be recognized by the flat uniform appearance of the iris—the absence of folds or radiating striations. This is best seen under oblique illumination with a magnifier. This atrophy sometimes involves certain sectors of the iris, others remaining nearly or quite normal. Dupuy-Dutemps[6] from a careful study of these cases concludes that the atrophy is trophic in character.

Causes of Iritis. Oral sepsis is believed by Campbell[7] to be one important cause. He has seen three cases in which there was neither syphilis nor rheumatism; but there was a well-marked alveolar pyorrhœa, with symptoms of septic anæmia. Putting the mouth in good condition, with

[1] Graefe's Archiv f. Ophthalmologie, 1905.
[2] Pathology of the Eye, vol. i.
[3] British Medical Journal, August 26, 1905.
[4] Journal of the American Medical Association, November 4, 1905.
[5] Annales d'Oculistique, October, 1905.
[6] Ibid., September, 1905.
[7] Lancet, July 22, 1905.

instillation of mydriatics in the eye, and use of general tonics cured all three cases rapidly.

In his paper on Diseases of the Eye from Autointoxication, Elschnig[1] reports seven cases of *uveitis*, six of which involved the iris, which seemed to be caused by autointoxication of intestinal origin. In all of them the urine showed excess of indican, and improvement was brought about by treatment directed to the intestinal indigestion. Aubineau,[2] in discussing the diagnosis of *syphilitic iritis*, suggests that autointoxication may be an important element in the causation of the numerous cases which do not show lesions characteristic of syphilis. Woods,[3] in discussing *recurrent iritis* says that some constitutional dyscrasia, as rheumatism or gonorrhœa, is always present.

De Lapersonne[4] questions whether a *blennorrhagic iritis* exists as a distinct disease. He thinks not. Although he admits that gonorrhœa has frequently an important relation to iritis, the latter is ascribed to a secondary infection rather than to the direct influence of the gonococcus, which has not been found in the iris or aqueous humor. Then the supposed gonorrhœal iritis yields best to the ordinary treatment for inflammation of the iris, as atropine and local bleeding, with pilocarpine sweats, and sodium salicylate, pyramidon and colchicum internally.

Burnett[5] in support of de Lapersonne's remark that iritis very rarely occurs in connection with recent gonorrhœa, says that in twenty-five years' connection with a large general dispensary, not a single case of gonorrhœal iritis had been referred to his service from the clinic for genitourinary disease, although cases of iritis from syphilis had come in large numbers. The iritis usually followed manifestations of rheumatism, after the trouble had become chronic; and chronic rheumatism, which is so often accepted as explaining the tendency to iritis, is often an autointoxication, and should be carefully considered from the standpoint of intestinal indigestion.

Iritis with Chronic Interstitial Nephritis. In some of the cases reported by Elschnig it is mentioned that the urine contained a small amount of albumin, but little importance is attached to this fact. In general, however, the finding of evidence of interstitial nephritis would be regarded as more important than the discovery of an excess of indican in the urine. Semple[6] reports a case of iridocyclitis in which the discovery of 0.1 per cent. of albumin and some large hyaline, granular, and epithelial casts led to the adoption of rigid diet and other treatment for the kidney lesions.

[1] Klinische Monatsblätter f. Augenheilk., November, 1905.
[2] Annales d'Oculistique, August, 1905.
[3] Ophthalmic Record, July, 1905.
[4] Archives d'Ophtalmologie, March, 1905.
[5] Journal of the American Medical Association, December 23, 1905
[6] American Journal of Ophthalmology, June, 1905.

The iritis immediately improved with the condition of the urine. Semple pertinently asks "why cannot the iris as well as the retina be the seat of the first signs of the general disease?"

Two cases of iritis occurring in the course of Bright's disease are reported by Alt,[1] who thinks it rather astonishing that we do not meet more frequently with these cases. He thinks they may be of some prognostic importance, as both his patients died, one ten months and the other two months after the occurrence of iritis. In both of them albuminuric retinitis had been recognized four and eight months respectively before the occurrence of iritis.

Recurrent Iritis. From the nine cases which he reports Woods[2] concludes, that in addition to the constitutional dyscrasia which is always present, there is an exciting cause for any relapse. This is some irritant, producing hyperæmia, as eye-strain from effort to use an eye incapable of its work, because of former disease, or refractive error; pulling on old synechiae by pupillary movements, exposure to wind, dust, etc. The only prophylaxis against recurrence is to discover and if possible prevent these exciting causes. Iridectomy has often been urged for recurrent iritis, and Hall[3] advocates early resort to it, to prevent exclusion of the pupil. After that has occurred he considers it of uncertain value. In three of Woods' cases it was done, but not early; and in two of them attacks occurred subsequently. We cannot estimate the preventive value of iridectomy done after a first attack of iritis, since the great majority of patients have no recurrence even without such treatment.

Uveal Tuberculosis. In reporting a case of *tubercle of the choroid* Carpenter and Stephenson[4] point out "that by far the most trustworthy sign of *acute miliary tuberculosis* is furnished by the discovery of tubercles in the choroid." They regard it as a not uncommon symptom, having found it in 50 per cent. of cases of acute miliary tuberculosis and tuberculous meningitis examined with the ophthalmoscope. Jessop[5] thinks choroidal tubercles are to be found in 50 per cent. of the cases postmortem, and in 30 to 35 per cent. with the ophthalmoscope. He thinks, too, that in miliary tuberculosis of the choroid tuberculous meningitis is nearly always present. Among fifteen cases of choroidal tubercle found postmortem, fourteen had meningitis.

Jessop has never come across a case he could prove to be primary intraocular tuberculosis, and he doubts if such a condition ever exists. In miliary tubercle of the choroid he has never seen vitreous opacities. In solitary tubercle of the choroid, of which he has collected twenty

[1] American Journal of Ophthalmology, July, 1905.
[2] Transactions of the American Ophthalmological Society, 1905.
[3] Texas State Journal of Medicine, December, 1905.
[4] The Ophthalmoscope, August, 1905.
[5] British Medical Journal, August 26, 1905.

cases, the vitreous was hazy in five, and in four was said to be normal. He believes that since the ocular lesion is never primary, excision should be done only for pain that unfavorably affects the patient's general condition. A case of chronic disseminated tuberculosis of the choroid and retina is reported by Schultz-Zehden,[1] who believes that it may occur, without evidence of tuberculosis elsewhere in the body, and that the prognosis is comparatively good.

Use of Tuberculin. The diagnosis and treatment of tuberculous iritis by use of Koch's tuberculin is the subject of a paper by Gamble and Brown,[2] who report a case of cure with vision of $\frac{20}{30}$, and give an exhaustive review of the literature. They conclude there is little question of the value and reliability of tuberculin as a diagnostic agent. They point out that it is well to begin with the lowest possible dose. They believe that most cases of tuberculous disease of the eye are of a character that can certainly be helped by tuberculin treatment. Von Hippel[3] has reported to the Heidelberg Ophthalmological Congress, fourteen additional cases of ocular tuberculosis treated with tuberculin, seven being cases of uveal tuberculosis. Of the latter two were cured, four were still under treatment, two being much improved. In one other the treatment had probably been beneficial. He warns against making subconjunctival injections. In the discussion of von Hippel's paper, Sattler stated he had used tuberculin in four cases of iris tuberculosis and two of tuberculous episcleritis. His results were very favorable, and he warmly recommends the method of treatment. Halben had treated three cases of tuberculous iridocyclitis, resulting in cure in from one to one-and-one-half years. Czermak had seen improvement from the use of tuberculin, and cure in one case of uveal tuberculosis.

In the discussion of Jessop's paper, Hess reported the use of tuberculin injections for diagnostic purposes in twenty-six cases. He thought that only when there was a local reaction, could the case be certainly regarded as one of tuberculosis. He had never seen any ill effects from its use, and in one case there had been evident improvement. In this same discussion, Hern had found tuberculin very useful as a means of diagnosis but useless in treatment.

Choroidal Lesions following Ptomaine Poisoning. Two striking cases of choroidal disease, following ptomaine poisoning with serious intestinal inflammation, are reported by Bull.[4] One occurred in a girl of fourteen, the other in a woman of twenty-seven. The acute nausea, vomiting diarrhœa and prostration were followed by chronic gastric symptoms

[1] Centralbl. f. Augenheilk., October, 1905, p. 298.
[2] Journal of the American Medical Association, October 14, 1905.
[3] Klinische Monatsblätter f. Augenheilk., August, 1905, p. 184.
[4] Transactions of the American Ophthalmological Society, 1905.

a pemphigoid eruption and impairment of vision. There was complete paralysis of accommodation and dilated pupils. In the choroid were numerous flat patches of exudate. These were yellowish white, and some of them had red margins; but none showed pigment deposits. Under tonic treatment, including arsenic and strychnine, the vision gradually came up to normal, accommodation was fully recovered, with normal pupils, and the patches in the choroid gradually became less noticeable.

Metastatic Panophthalmitis. A case occurring thirty-one days after confinement, and preceded by sudden, violent uterine hemorrhage, but in which no focus of infection was found by clinical examination of the uterus, is reported by de Schweinitz.[1] Chaillous[2] has also reported a case occurring in a woman who had been admitted to the hospital two weeks before for uterine hemorrhage and threatened abortion at the third month. At this time she had a chill and fever, but became free from fever and had no recurrence of the hemorrhage. She was suddenly attacked with complete blindness of the left eye and swelling of the lids. On examination a subconjunctival abscess was found connecting with the interior of the globe by a small fistulous opening through the sclera.

In both the above cases streptococci were found and in de Schweinitz's case staphylococci also. These organisms were also revealed by microscopic examination of a case reported by Terson.[3] A man received a kick on the left side of the abdomen and a week later suddenly developed chills and fever. On the thirteenth day after his injury sight was impaired, and the next day pus was noticed in the anterior chamber. The sclera perforated and the eyeball atrophied.

Endogenous Panophthalmitis occurring in an eye that had been operated on successfully for cataract, four months before, was reported by Csapodi[4] to the Hungarian Ophthalmological Congress. In discussing Csapodi's case, Mohr reported a violent iridochoroiditis, causing occlusion of the pupil and blindness which occurred in an infant aged nine months. Hoor cited cases of endogenous panophthalmitis occurring in connection with influenza and vaccinia. Fejer mentioned one consecutive to furunculosis. Lippa gave two cases attending pneumonia.

A case of *tuberculous panophthalmitis* in which extended bacteriologic study showed mixed infection by both tubercle bacilli and pseudo-diphtheria bacilli is reported by Demaria.[5] The patient, a girl aged eleven, was suffering from pulmonary lesions. Metastatic ophthalmia is reported by Morax,[6] occurring four days after the commencement of

[1] Ophthalmic Record, May, 1905, p. 236.
[2] Recueil d'Ophtalmologie, February, 1905, p. 111.
[3] Annals of Ophthalmology, July, 1905.
[4] Zeitschrift f. Augenheilk., September, 1905, p. 332.
[5] Klinische Monatsblätter f. Augenheilk., Supplement, 1905.
[6] Annales d'Oculistique, November, 1905.

a meningitis due, as determined by lumbar puncture, to the meningo-coccus. The inflammation subsided without perforation of the sclera, but was followed by shrinking of the eyeball.

PANOPHTHALMITIS FROM DIRECT INFECTION. Two cases of this disease are reported by Chaillous[1] in which the bacteriological exami-nation showed the invading organism to be the anaerobic *bacillus per-fringens*. In both cases this gained entrance through a penetrating wound, causing very severe symptoms within a few hours, for which the eyeballs were enucleated.

In researches reported by Polatti[2] it seems to have been established that the common saprophytic organism, the *bacillus subtilis*, becomes highly pathogenic when introduced into the vitreous, which seems to furnish it an excellent culture medium. Polatti thinks that more cases would be reported if careful microscopic examinations were made, although the bacillus is not very frequently carried into the vitreous upon foreign bodies.

SYMPATHETIC DISEASE.

Causes of Sympathetic Inflammation. The new theory of sympathetic ophthalmitis proposed independently by Brown, Pusey, and Golovine, was discussed one year ago.[3] Golovine[4] has now set it forth more elabo-rately, and supported it by some experiments. His suggestion is that a special form of inflammation attacking the exciting eye brings about, with or without the influence of micro-organisms, the formation of cyto-toxins capable of acting on certain cells of the uveal tract. Through the general circulation, or otherwise, such cytotoxins may reach the uveal tract of the other eye, and there set up a similar destructive process. He injected an emulsion, made of the ciliary muscle and iris of the dog, into the peritoneal cavity of the rabbit. The serum of such rabbits were injected into the eyes of dogs. Such a cytotoxic serum always caused slight irritation, slight circumcorneal injection, keratitis punctata, and iritis with fibrinous exudate in the anterior chamber. But it never caused a purulent inflammation. The experiments seem to show that cytotoxins capable of acting on the uveal tract, can be thus developed within an animal of another species; and so developed are capable of causing some-thing like the inflammation in question. Such a development is quite in harmony with what is known of cytotoxins in general. But the develop-ment of a cytotoxin in the body capable of acting upon cells of that indivi-dual or species is a different matter, and is opposed to most of our

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[1] Annales d'Oculistique, August, 1905.
[2] Annali di Ottalmologia, 1905, p. 56-73.
[3] PROGRESSIVE MEDICINE, June, 1905.
[4] Archives d'Ophtalmologie, February, 1905.

knowledge of such bodies. If it could be shown that such a thing does occur in the uveal tract, it would better explain many of the facts of sympathetic ophthalmia than anything previously propounded.

Sympathetic Ophthalmitis after Panophthalmitis. It is often stated that an eye lost by panophthalmitis will not cause sympathetic ophthalmia. In most cases it will not. But a number of instances are now on record in which sympathetic inflammation has resulted from an eye that has been the seat of panophthalmitis. New cases of the kind are reported by Würdemann[1] and Zentmayer.[2] In both instances the exciting eye was enucleated after the appearance of sympathetic inflammation in the other; but both cases went on to blindness. Zentmayer concludes that it is the mild cases of purulent uveitis which excite sympathetic inflammation, and only after panophthalmitis of a virulent type should the shrunken globe be considered harmless.

SYMPATHETIC OPHTHALMITIS AFTER ENUCLEATION. It is well known that after removal of an eye capable of causing sympathetic ophthalmitis, a certain period elapses before the remaining eye becomes free from the liability to the disease. This period is usually supposed to be not more than three or four weeks. Snell[3] reports a case in which the outbreak occurred thirty-two days after enucleation, and one hundred and six days after the original injury. He has seen four such cases, in two of which the sympathizing eye became entirely blind.

RECOVERY FROM SYMPATHETIC OPHTHALMIA. A good many cases of recovery from sympathetic inflammation have been recorded, particularly after early enucleation of the exciting eye. A few cases have been reported in which the exciting eye retained useful vision, and was of great service to the patient, although the sympathizing eye was lost. In a case reported by Snell[4] the exciting eye retained such good vision that its removal was out of the question. A well-marked attack of sympathetic inflammation, however, occurred in the other eye, five weeks after the injury. But under treatment the attack subsided, and vision of $\frac{6}{5}$ was ultimately obtained in both eyes.

DISEASES OF THE RETINA AND OPTIC NERVE.

Retinal Lesions of Pregnancy. At the Halle University clinic, Polte[5] examined the eye-grounds of two hundred women near the end of pregnancy. Contrary to what has been reported by Bosse, he found no recent fundus lesions in the great majority of cases. Among these patients

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[1] Ophthalmic Record, November, 1905.
[2] Journal of the American Medical Association, August 19, 1905.
[3] Transactions of the Ophthalmological Society of the United Kingdom, 1905.
[4] Ibid.   [5] Klinische Monatsblätter f. Augenheilk., December, 1905.

eighteen had albuminuria, and six suffered from eclampsia. Of these six, five had normal eye-grounds, and one had unimportant ophthalmoscopic changes. In two of the cases of albuminuria, with casts, there was albuminuric retinitis. In one of these, nine days after confinement, the fundus had become normal in one eye, and greatly improved in the other. In the other case the retinal lesions were limited to two small white spots, irregularities of the veins, with some blurring of the outline of the disk. Two other cases were found showing optic atrophy, from renal retinitis that had arisen in earlier pregnancies.

Retinal Cyanosis. New cases have been reported and papers discussing retinal cyanosis have been published by Babinski and Toufesco[1] and Posey.[2] The latter brings together eighteen cases, only four of which have come to autopsy. The cyanosis has usually been ascribed to patency of the foramen ovale. Nagel concluded that if the ophthalmoscope showed both the retinal arteries and veins darker and broader than normal, an opening between the two sides of the heart was assured. In Carpenter's case the opening was found between the ventricles, the foramen ovale having closed. In Babinski's case there was believed to be an acquired stenosis of the pulmonary artery, and retinal cyanosis was discovered although there was no general cyanosis. The retinal appearances include the striking enlargement and tortuosity of the vessels. Both arteries and veins are darker than normal, and the veins particularly are very broad and tortuous. An unusually large number of visible vessels emerge from the optic disk; and the smaller branches are more evident throughout the fundus. As Posey points out the diagnosis of congenital heart disease being at times practically impossible by the physical signs, the examination of the eye-grounds will be of especial value.

Blindness from Paraffin Injections. Additional cases of blindness following the injection of paraffin to correct the deformity of saddle-nose, are reported by Mintz[3] and Uhthoff.[4] This makes five recorded cases of this accident. In these cases the ophthalmoscope showed obstruction of the retinal circulation. In Mintz's case there occurred paralysis of the extraocular muscles and exophthalmos. He suggests, as the explanation, a thrombosis extending through the veins of the orbit to the central vein of the retina. In the other cases the ocular condition has been spoken of as one of "retinal embolism;" but it is certain that under this name many cases of retinal thrombosis have been reported, and the explanation of Mintz seems far more simple and rational.

[1] Annales d'Oculistique, February, 1905.
[2] American Journal of the Medical Sciences, September, 1905.
[3] Centralbl. f. Chirurgie, 1905, xxxii., No. 2.
[4] Transactions of the German Congress of Naturalists and Physicians, 1905

The number of these cases of blindness from such paraffin injections, and the apparent impossibility of foreseeing them, make it the duty of the surgeon to warn his patient of the possible risk attending such an operation, if it does not render the operation wholly inadvisable. Hertel[1] experimenting with paraffin prothesis, had two dogs die of pulmonary fat embolism. On this account he advised that the paraffin be introduced in the orbit in solid form instead of by injection.

Antipyrin for Optic Atrophy. Valude observed, some fifteen years ago, improvement in optic atrophy after the use of antipyrin. He now reports[2] that its usefulness is limited to cases of descending atrophy, following acute cerebral disease. He reports a case in which it followed cerebral involvement in typhoid fever. Vision was brought up, in one eye, from perception of hand movements to $\frac{1}{4}$. He employs it in a solution composed of cocaine one part, antipyrin 100, distilled water 200. Of this 2 c.c. are injected hypodermically each day. If no improvement is noted after twenty-five injections, it is useless to continue; but if it proves beneficial, series of twenty to twenty-five injections may be repeated at intervals.

DISEASES OF THE CRYSTALLINE LENS.

Heredity in the Causation of Cataract. A most valuable study on heredity in the various forms of cataract has been made by Nettleship.[3] He first divides his cases into acquired, or postnatal, and congenital cataracts. Of the first class he has studied the history of one hundred and forty-five families, containing upward of five hundred affected persons. In one hundred and twenty-two families the cataract was senile, appearing after the age of forty years. In twenty-five families it was juvenile. He finds that when senile cataract occurs in more than one generation, it almost always occurs in continuous succession, and appears very seldom to skip a generation. The same was noted in the juvenile acquired cataracts. He found that senile cataract was transmitted rather more frequently through the mother than the father—sixty-seven to forty-five. But he points out that in the population there are more females than males, and that the disproportion is larger at the time of life that senile cataract is likely to occur. He also finds that in England, women are somewhat more liable to senile cataract than men, so that these points may explain the apparent greater tendency to female transmission.

But there does seem to be in certain families a marked preference of the disease for one sex; in some families for the males, in others for the

[1] Graefe's Archiv f. Op'nthalmologie, 1905, lv. Part 2.

[2] Annales d'Oculistique, March, 1905.

[3] Royal London Ophthalmic Hospital Reports, vol. xvi. Part 3.

females. Consanguinity of parents seems to be rare, except in the group of complete congenital cataracts. Nettleship notes, however, that some of the families with the longest cataract pedigrees had been settled for long periods in remote country places where consanguineous marriages would be rather likely to occur. He does not find that the tendency to cataract is associated with any lessened fertility, or that the members of such families are likely to be short-lived. There does seem, however, to be a tendency for hereditary senile cataract to appear earlier or to ripen earlier in the younger generations.

Of *congenital cataracts* he has brought together two hundred and thirty-eight cases, ninety were males and ninety-three females; in the other cases the sex is not given. In some families an unusually large proportion of children died at birth or in early infancy, but there was no mention of syphilis. In four cases the parents were first cousins. He divides the congenital cataracts into early complete cataract, axial or spindle, or coralliform cataract and lamellar cataract. From many of the older reports it is impossible to judge the form of cataract present. While the same form often appears in successive generations, there are many instances in which other forms also occur. Nettleship's paper strongly suggests the possible value of such studies regarding heredity in other diseases.

OCULAR REMEDIES.

Local Anæsthetics. STOVAINE has been proven an efficient local anæsthetic. It is readily soluble in water, and aqueous solutions are not altered by prolonged boiling. When raised to a temperature of 120 C., it slowly decomposes. Its effects on the accommodation and pupil are similar to those of cocaine; but it does not produce local anæmia. The anæsthesia secured by it seems to be as complete, and about as lasting as that caused by cocaine. It is used in solutions of a similar strength. Darier[1] recommends for prolonged anæsthesia the subconjunctival injection of a solution containing equal parts of cocaine, stovaine, and acoine. Luke[2] points out that stovaine must not be used hypodermically with adrenalin, because the mixture is likely to produce local gangrene. Coakley,[3] using it in the nose, finds that patients complain of its odor, which resembles that of stale fish.

ALYPINE, a still newer local anæsthetic, is also extremely soluble in water, is not precipitated by the alkaline fluids of the body, and its properties are in nowise impaired by boiling for ten minutes. Its fatal dose for the

[1] Ophthalmoscope, March, 1905.
[2] Scottish Medical and Surgical Journal, August, 1905.
[3] Medical News, April 15, 1905.

lower animals was found by Impens[1] to be double that of cocaine. It also seems to be about as efficient as cocaine, and is used in 2 per cent. or 4 per cent. solutions. It causes decided hyperæmia of the parts. Both alypine and stovaine cause slight irritation when instilled into the eye; but not much, if any, more than is caused by cocaine.

NOVOCAINE has been suggested by Braun[2] as another addition to the list of local anæsthetics. Concentrated solutions, or even the crystals can be applied to the cornea without causing irritation. But the anæsthesia produced by it is rather brief, and on this account it is not likely to come into general use.

Arecoline, an alkaloid obtained from the areca nut, is a myotic which produces a quick, brief contraction of the pupil and spasm of the ciliary muscle. It has been used to reduce intraocular tension, but Santos Fernandez[3] finds that it causes a shrinking of the eyeball. On this account it should not be used in glaucomatous eyes which possess some vision. But he believes it will be very valuable in cases of progressive staphyloma and hydrophthalmos.

The High Frequency Current. Coover[4] reports great benefit from applications of the high frequency current to eyes in which there is a nontoxic amblyopia. He reports nine cases, four of which had suffered from strabismus. The application was followed by immediate improvement in vision which seemed permanent. From its use in trachoma, Harman[5] saw no benefit in a trial on seven cases. Lester[6] reports one case of great improvement in vitreous opacity due to hemorrhage; and he has seen improvement in *ophthalmoplegia externa*.

[1] Deutsche med. Wochenschrift, 1905, No. 29.
[2] Ibid., No. 42; p. 1667.
[3] Recueil d'Ophtalmologie, March, 1905.
[4] New York Medical Journal, October 14, 1905.
[5] British Medical Journal, August 26, 1905.
[6] Transactions of the American Ophthalmological Society, 1905.

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